Engine Electrical

Specifications

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Battery Hold Down Retainer Nut	17 Nm	13 lb ft
Battery Negative Cable to Engine (2.4L)	41 Nm	30 lb ft
Battery Negative Cable to Engine (4.3L)	17 Nm	13 lb ft
Battery Negative Cable to Frame (2.4L)	6 Nm	53 lb in
Battery Negative Cable to Frame (4.3L)	6 Nm	53 lb in
Battery Negative Cable to Radiator Support (2.4L)	6 Nm	53 lb in
Battery Negative Cable to Radiator Support (4.3L)	6 Nm	53 lb in
Battery Positive Cable to Engine (4.3L)	6 Nm	53 lb in
Battery Positive Cable to Generator Nut	10 Nm	88 lb in
Battery Positive Cable to Junction Block Bolt Nuts	8 Nm	71 lb in
Battery Positive Cable to Starter Nut	10 Nm	88 lb in
Battery Terminal Bolts	5 Nm	44 lb in
Battery Tray Bolts	25 Nm	18 lb ft
Differential Carrier Shield Bolts	25 Nm	18 lb ft
Engine to Transmission Brace Bolts	50 Nm	37 lb ft
Engine Wiring Harness Bracket to Generator Mounting Bracket Bolt	25 Nm	18 lb ft
Engine Wire Harness to Starter Nut	1.9 Nm	17 lb in
Generator Mounting Bolts (4.3L)	50 Nm	37 lb ft
Generator Mounting Bolt – Upper (2.4L)	25 Nm	18 lb ft
Generator Mounting Bolt – Lower (2.4L)	50 Nm	37 lb ft
Generator Mounting Brace to Generator Bolt (2.4L)	25 Nm	18 lb ft
Generator Mounting Bracket Bolts and Nut (4.3L)	41 Nm	30 lb ft
Generator Output (Bat) Terminal Nut	17 Nm	12 lb ft
Generator Secure Bracket Mounting Bolt (2.4L)	25 Nm	18 lb ft
Heater Hose Bracket to Generator Bolt (4.3L)	25 Nm	18 lb ft
Power Steering Pump Mounting Bolts (2.4L)	25 Nm	18 lb ft
Starter Motor Mounting Bolts (2.4L)	40 Nm	29 lb ft
Starter Motor Mounting Bolts (4.3L)	50 Nm	37 lb ft

Specifications

Battery Usage

Non-Cold Weather Option Top-Post Battery	
Applications	Specification
JBGM Part Number	15041998
Cold Cranking Amperage (CCA)	590 A
Reserve Capacity Rating	90 Minutes
Replacement Battery Number	54AH
Cold Weather Option Side-Post Battery	
Application	Specification
JBGM Part Number	19001808
Cold Cranking Amperage (CCA)	690 A
Reserve Capacity Rating	90 Minutes
Replacement Battery Number	54AH

Specifications

Starter Motor Usage

Applications	Starter Type
2001-S/T TRK (China)	

Applications	Starter Type
2.4L (LG1)	9000846
4.3L (LG3)	12564107

Specifications

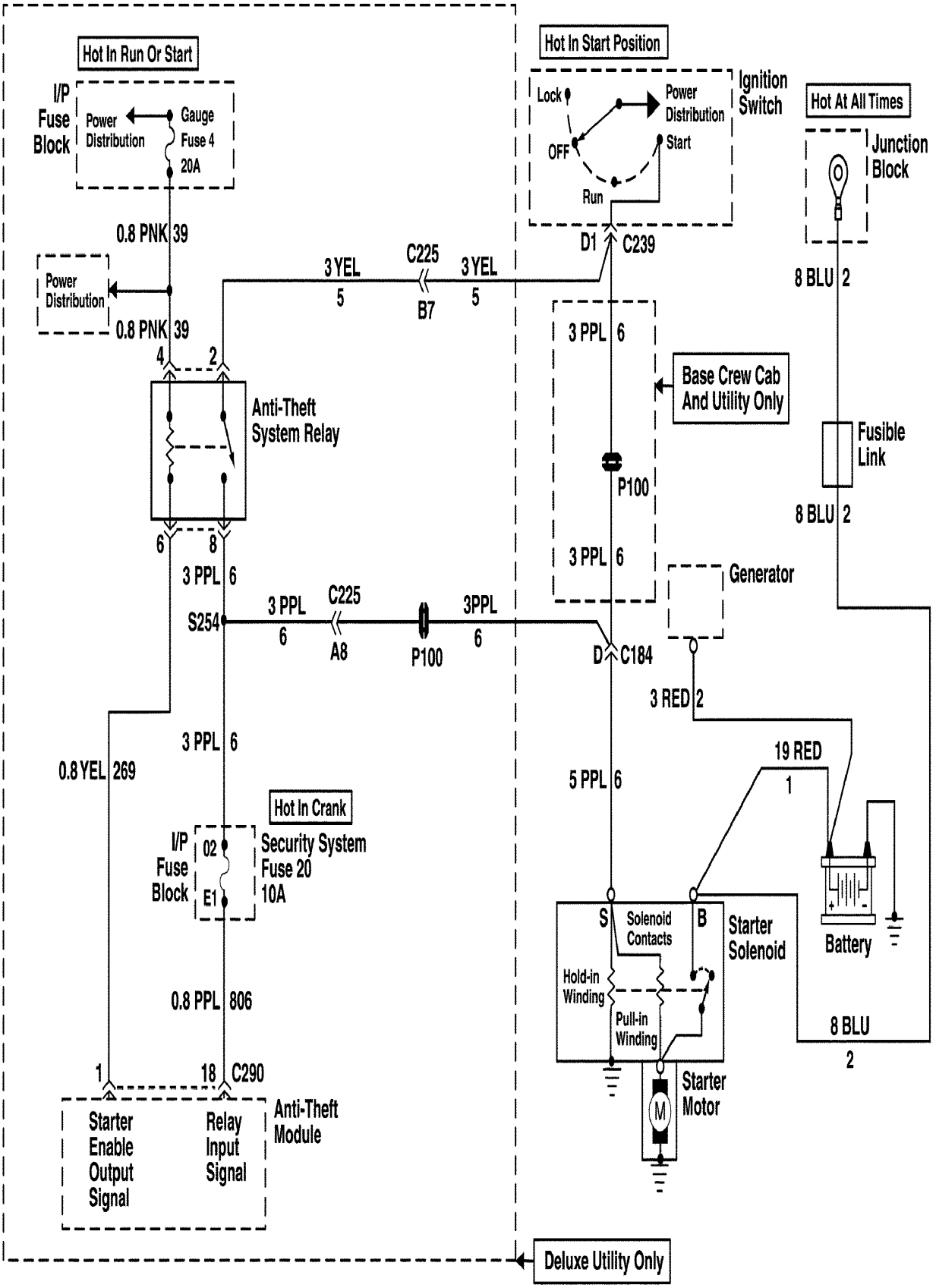
Generator Usage

Application	Specification	
	2.4L	4.3L
Generator Model	93278385	10480167
Rated Output	100 A	100 A
Load Test Output	70 A	70 A

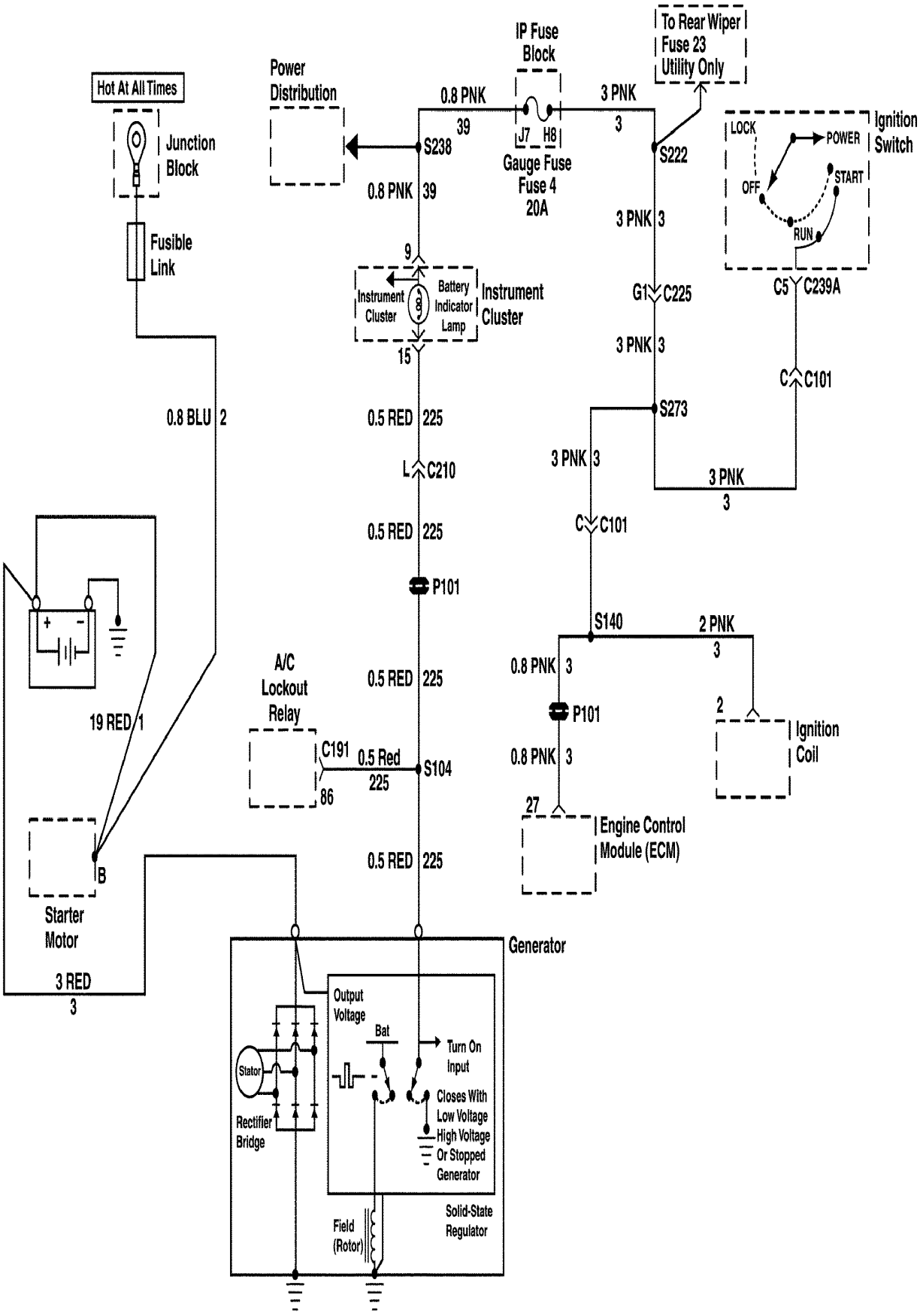
Schematic and Routing Diagrams

Starting and Charging Schematics

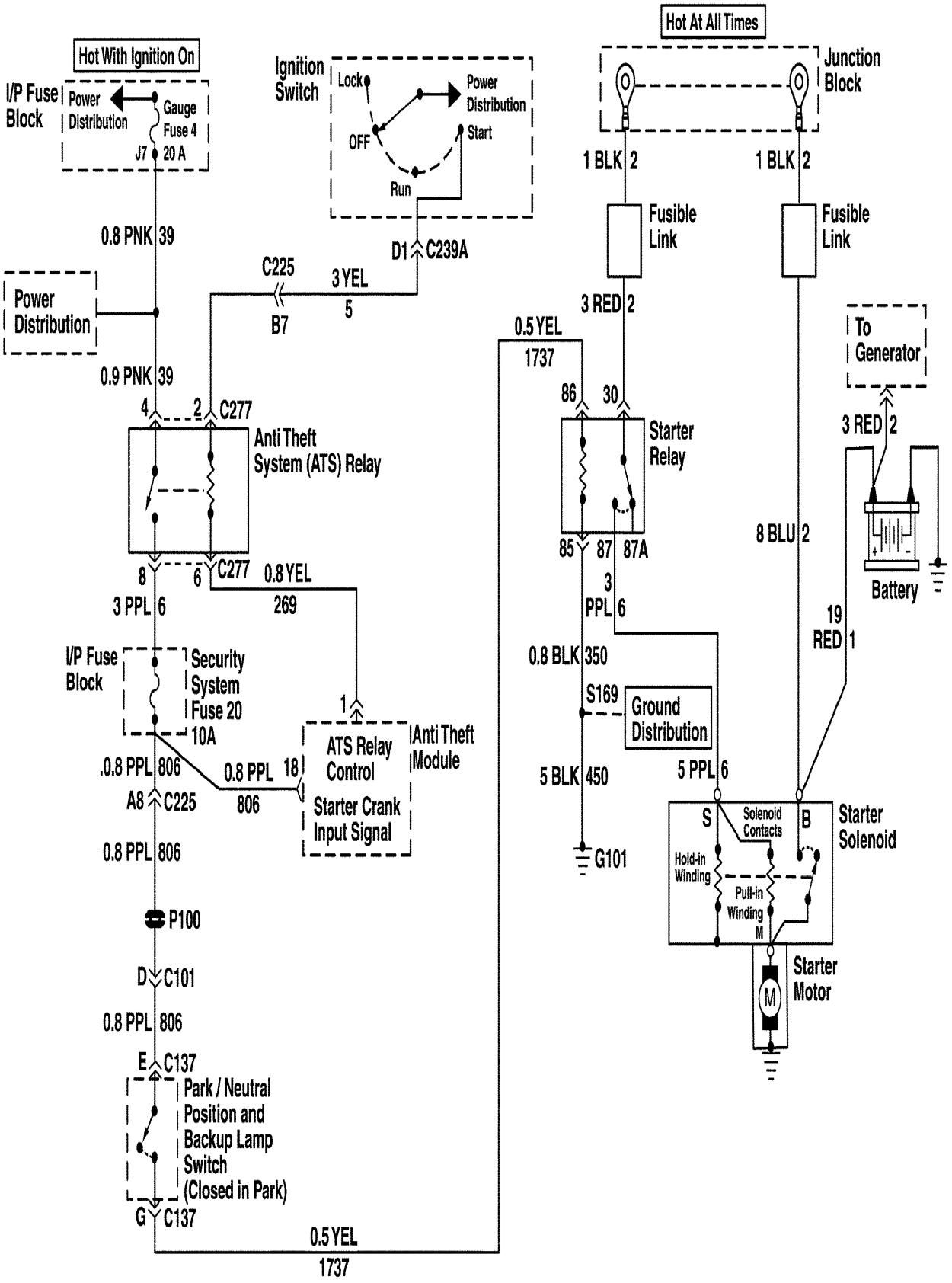
Starting (2.4L):



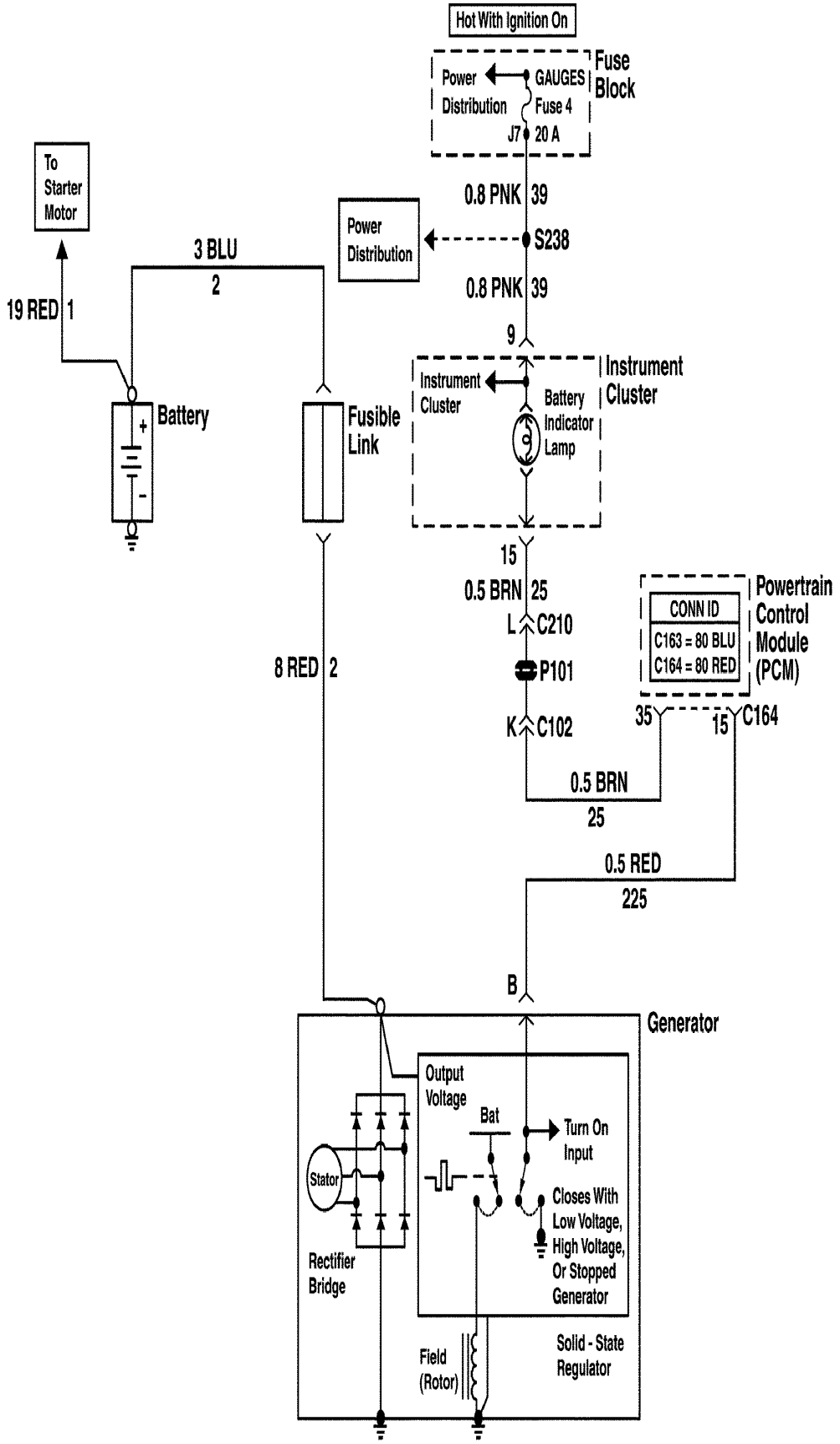
Charging (2.4L):



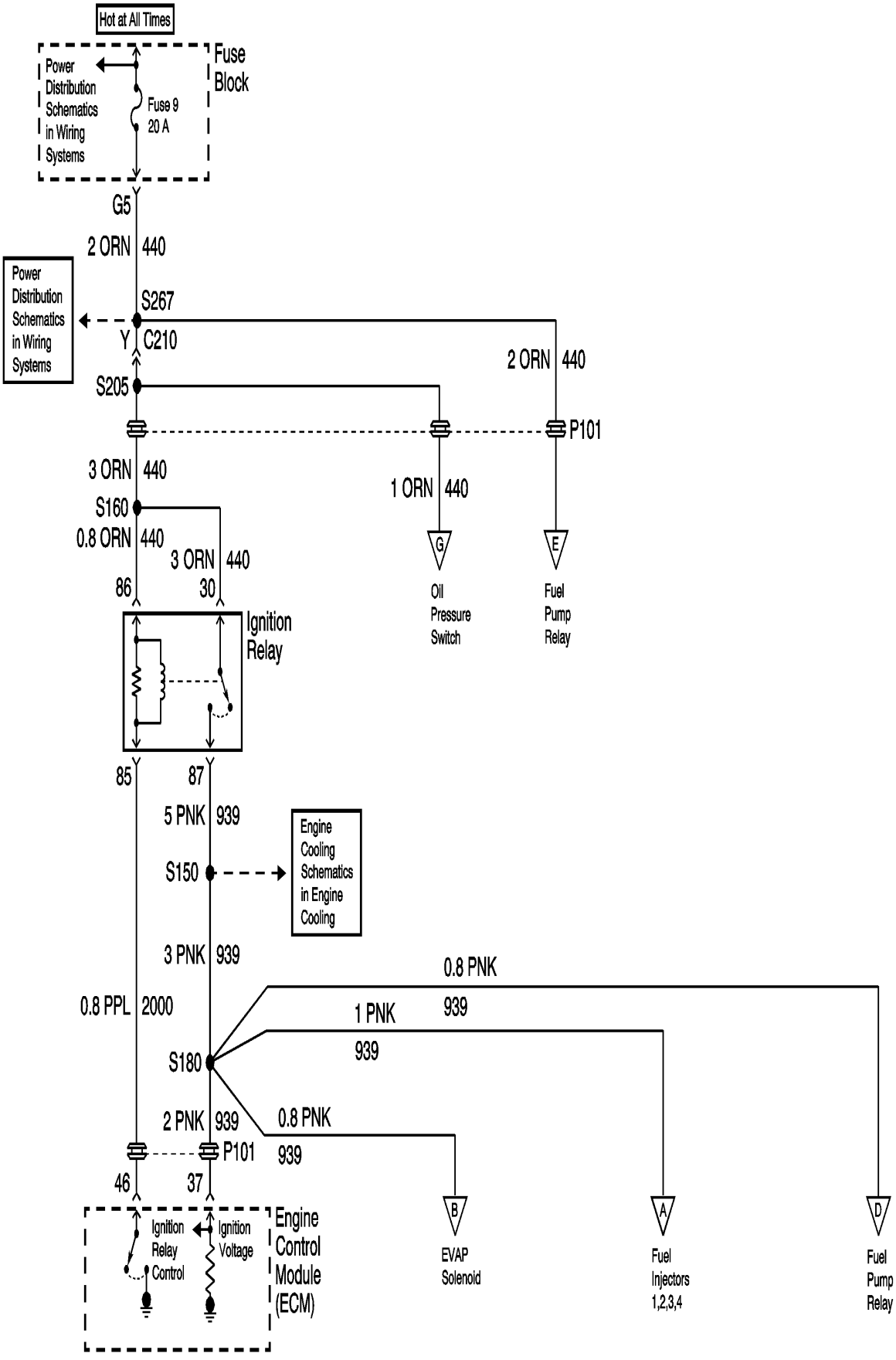
Starting (4.3L):



Charging (4.3L):



Ignition Relay – 2.4L:

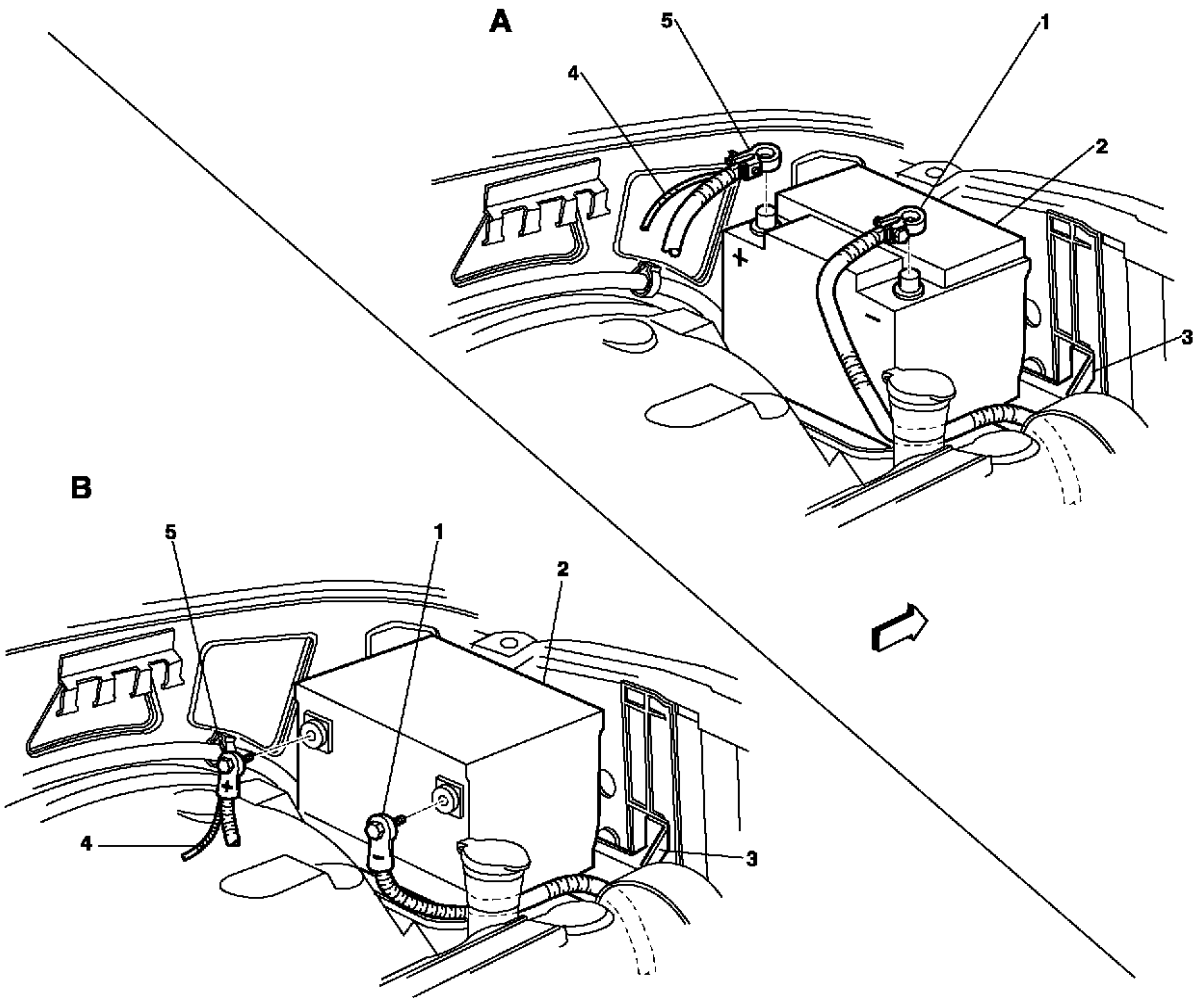


Component Locator

Engine Electrical Component Views

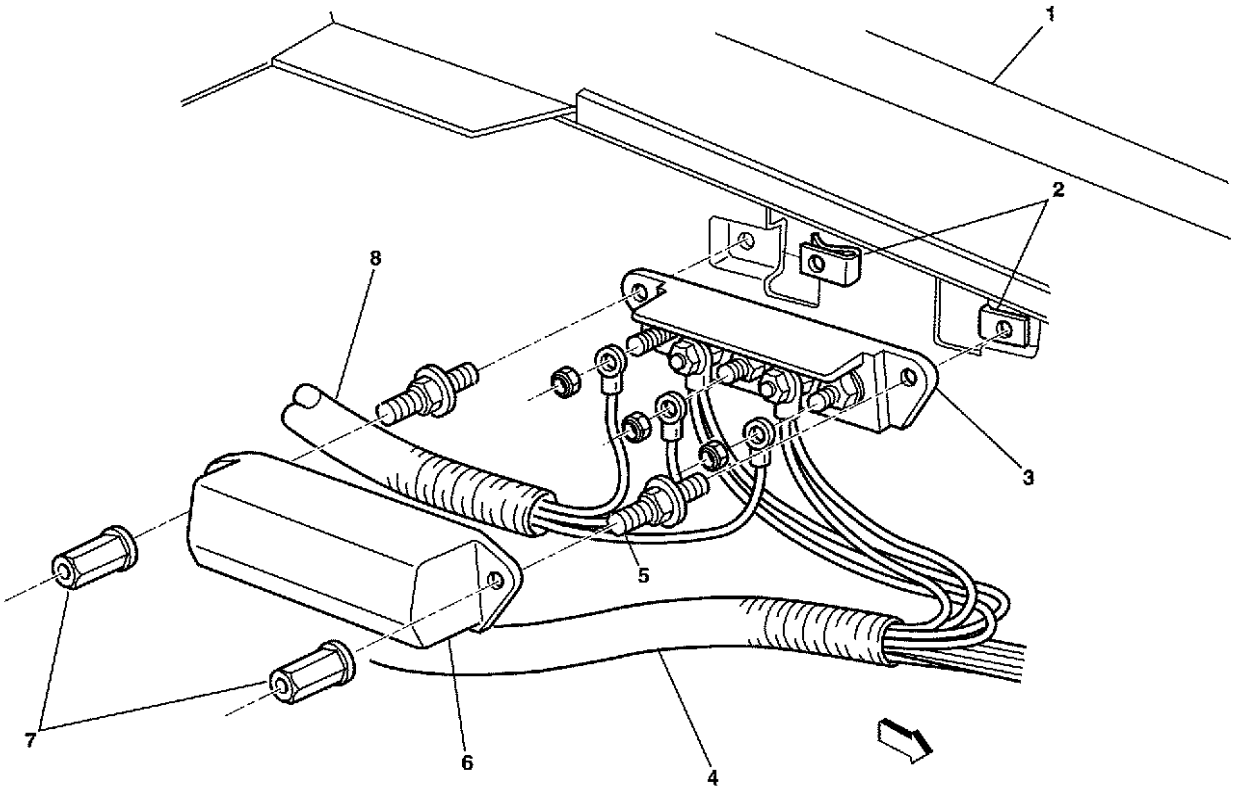
2001-S/T TRK (China)

Battery:



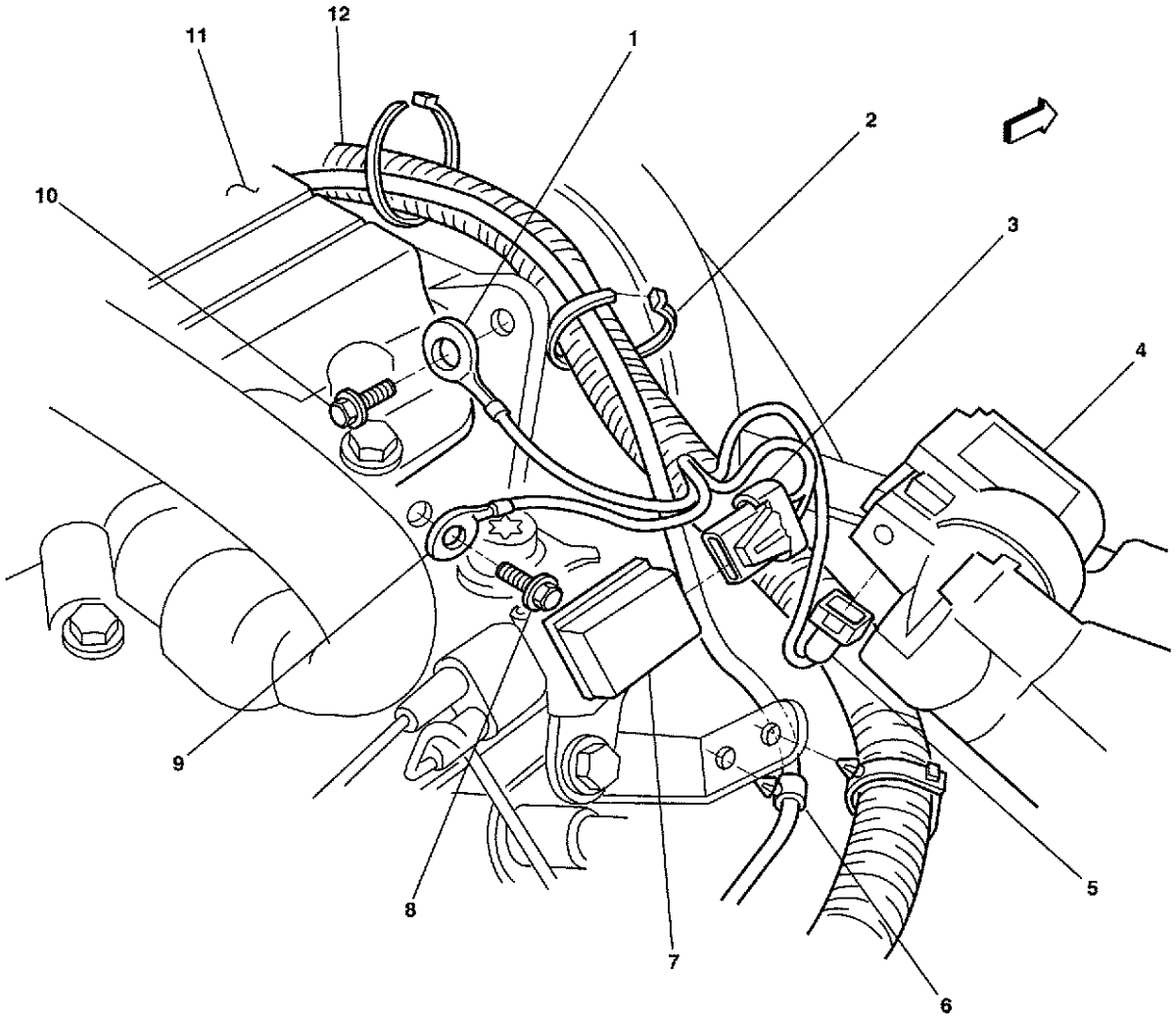
1. Battery Negative Cable
2. Battery (2.4L Engine Shown, 4.3L Engine Similar)
3. Battery Tray
4. Battery Positive Cable to Generator
5. Battery Positive Cable
6. Top Post Battery
7. Side Post Battery (Cold Weather Package)

Power Junction Block:



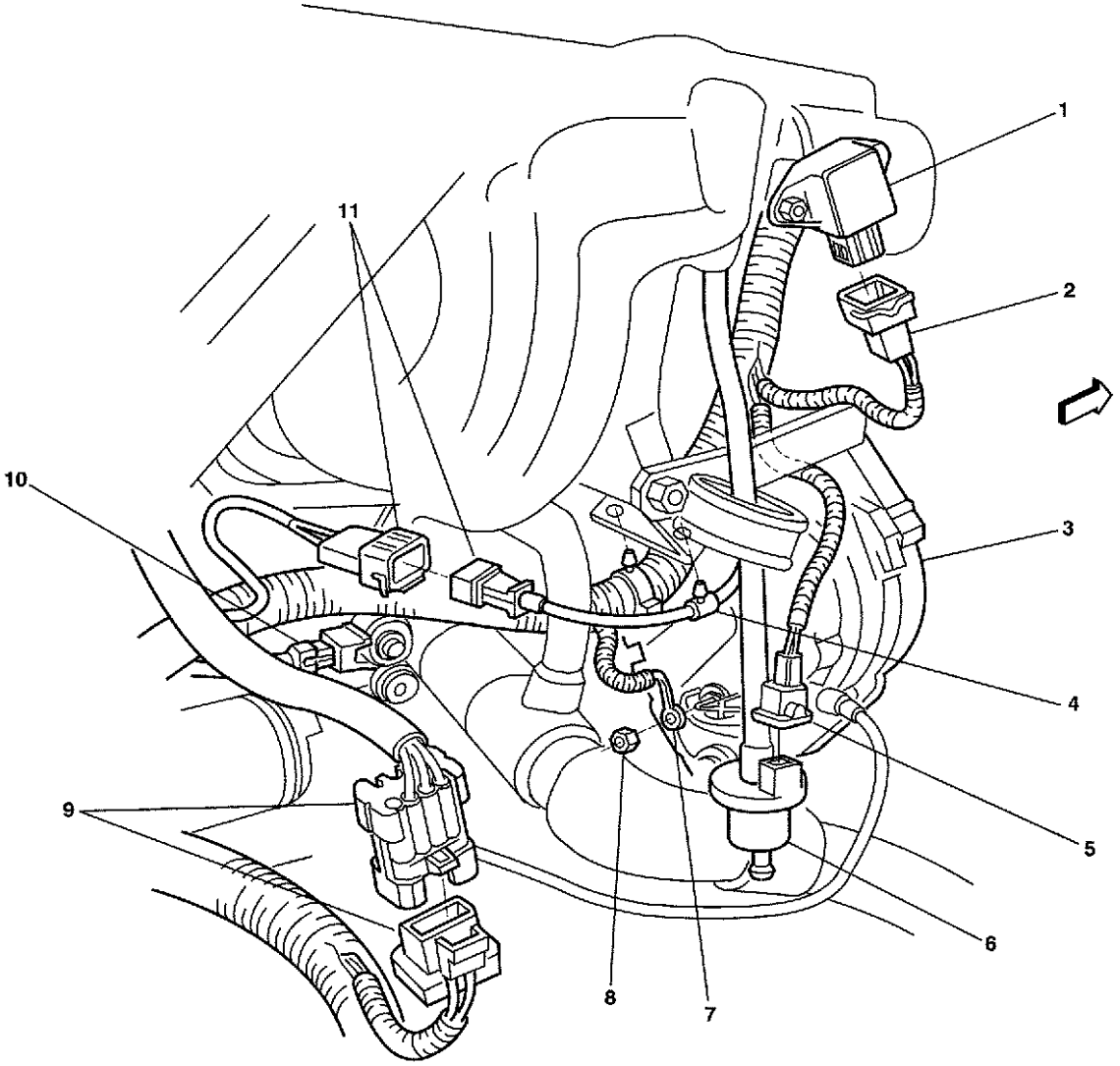
1. LF Fender
2. Junction Block Mounting Nuts
3. Junction Block
4. Dash Harness
5. Junction Block Mounting Bolts
6. Junction Block Cover
7. Junction Block Cover Mounting Nuts
8. Engine Harness

2.4L Engine Right Side — View 1:



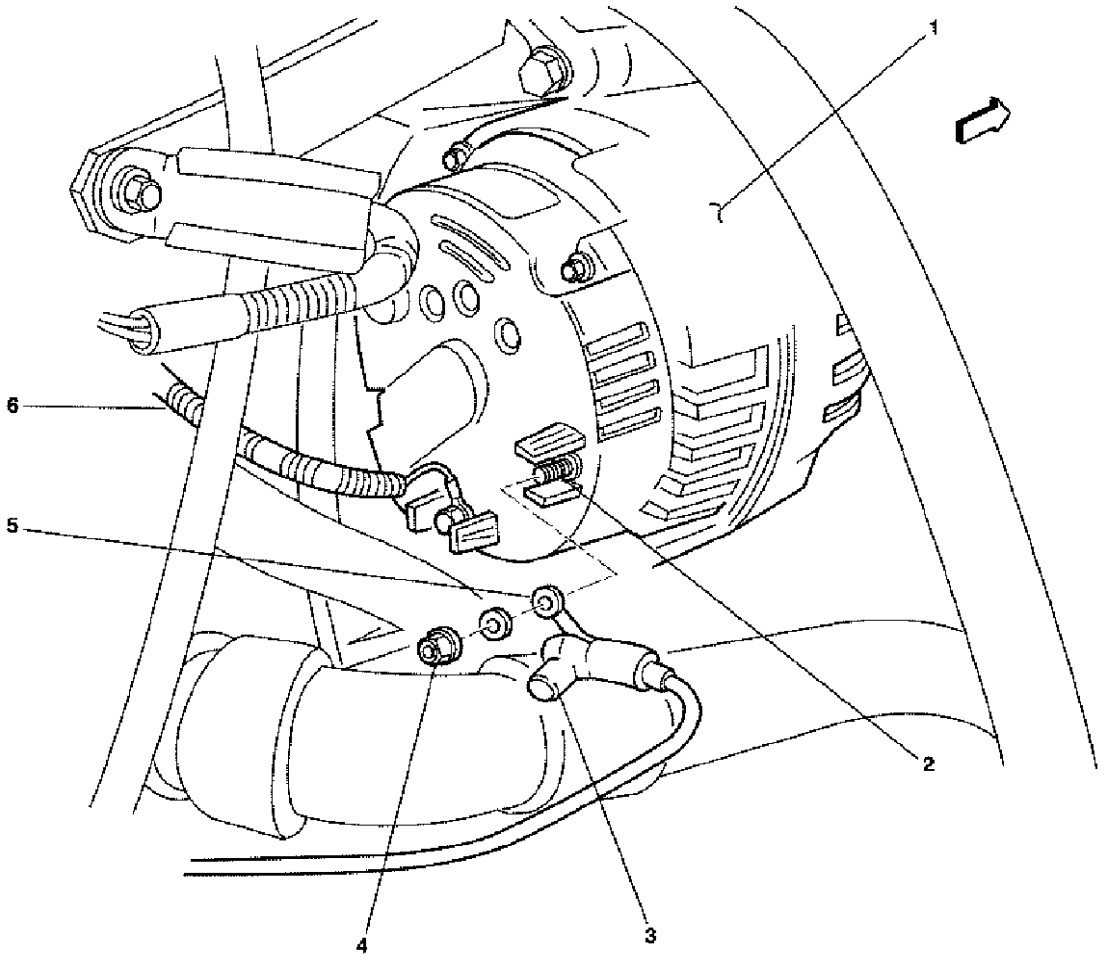
1. Ground Harness Terminal
2. Harness Strap
3. Engine Harness
4. Idle Air Control (IAC) Valve
5. Idle Air Control (IAC) Valve Harness Connector
6. Crankshaft Position (CKP) Sensor Harness Retainer
7. Bracket
8. Ground Harness Terminal Bolt
9. Ground Harness Terminal
10. Ground Harness Terminal Bolt
11. Engine Cam Cover (2.4L)
12. Engine Harness

2.4L Engine Right Side — View 2:



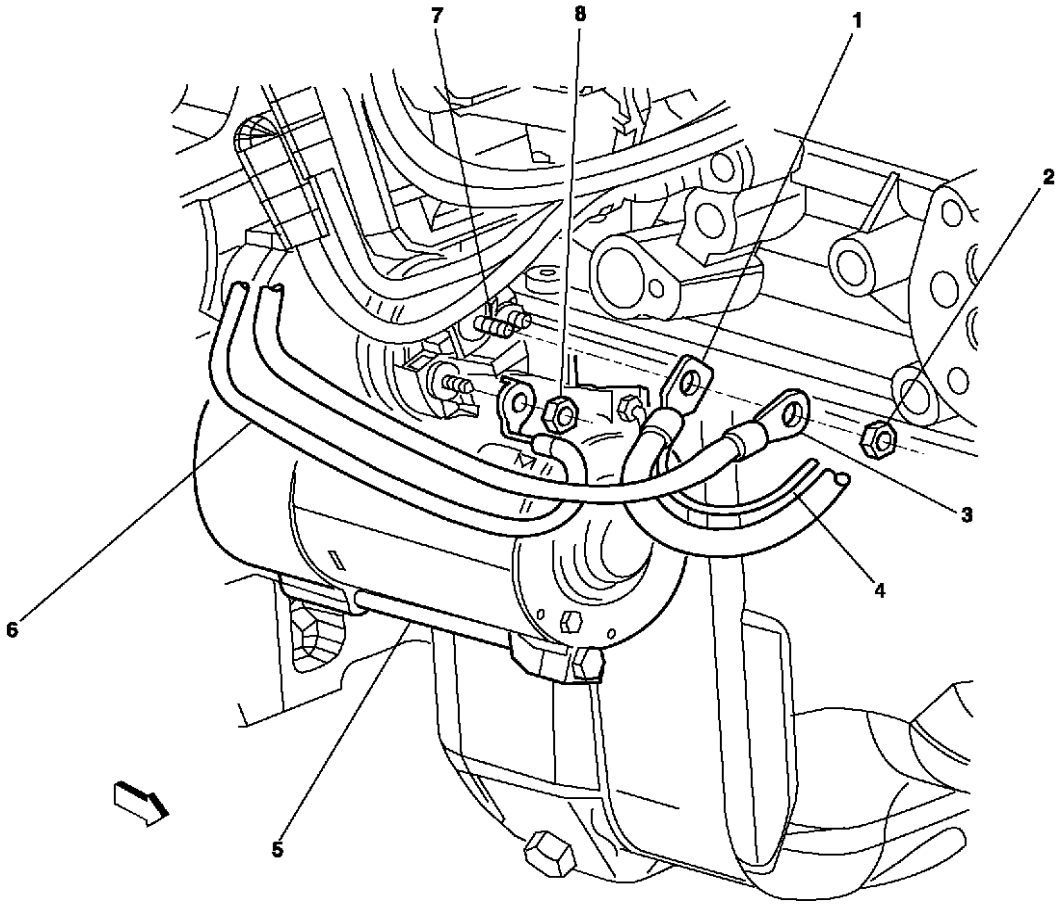
1. Manifold Absolute Pressure (MAP) Sensor
2. Manifold Absolute Pressure (MAP) Sensor Harness Connector
3. Generator
4. Crankshaft Position (CKP) Sensor Harness Retainer
5. Evaporative Emission (EVAP) Canister Purge Solenoid Harness Connector
6. Evaporative Emission (EVAP) Canister Purge Solenoid
7. Ground Harness Terminal
8. Ground Harness Terminal Retaining Nut
9. Fuel Injection Harness Connector
10. Knock Sensor (KS)
11. Crankshaft Position (CKP) Sensor Harness Connector

2.4L Engine Right Side — View 3:



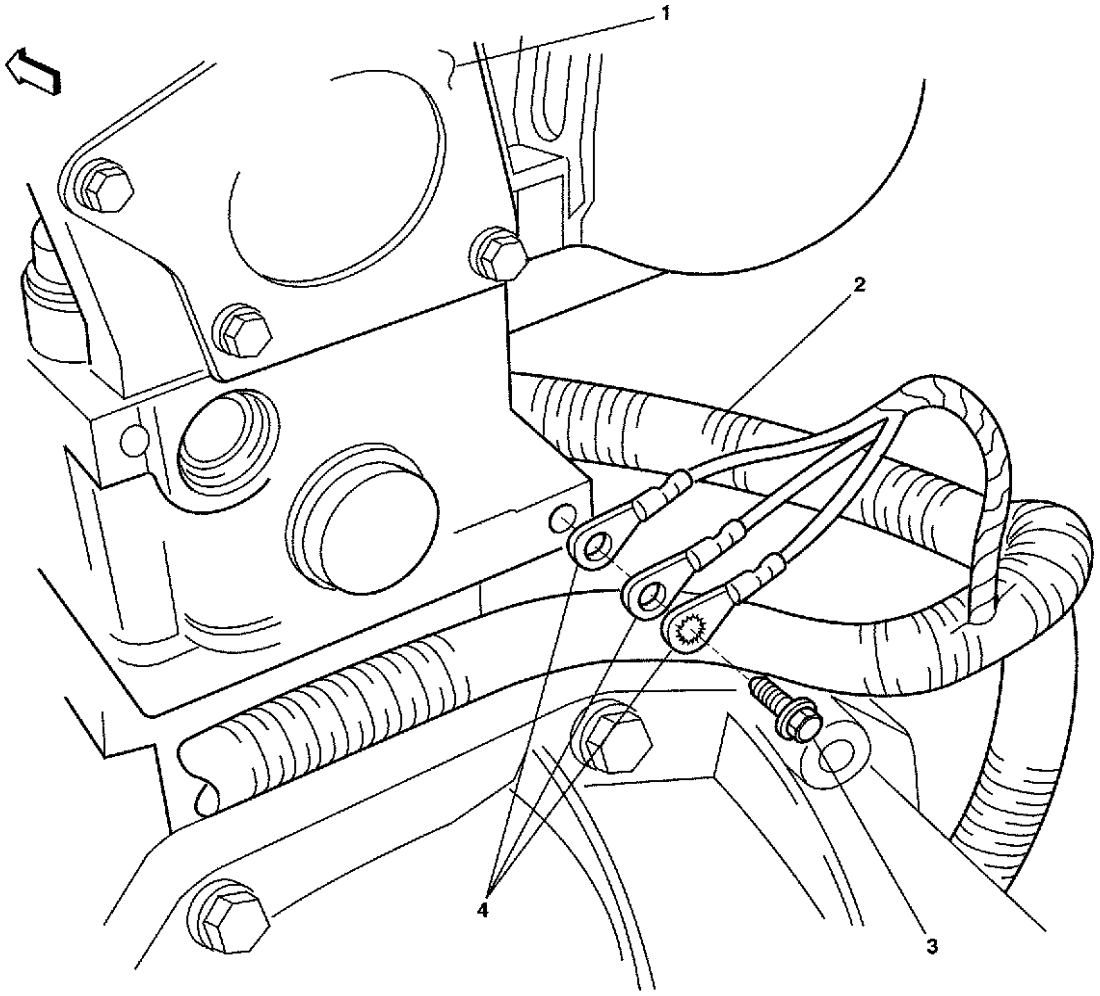
1. Generator
2. Generator Positive Stud
3. Battery Positive Boot
4. Battery Positive Cable Retaining Nut
5. Battery Positive Cable
6. Engine Harness to Instrument Panel

2.4L Engine Right Side — View 4:



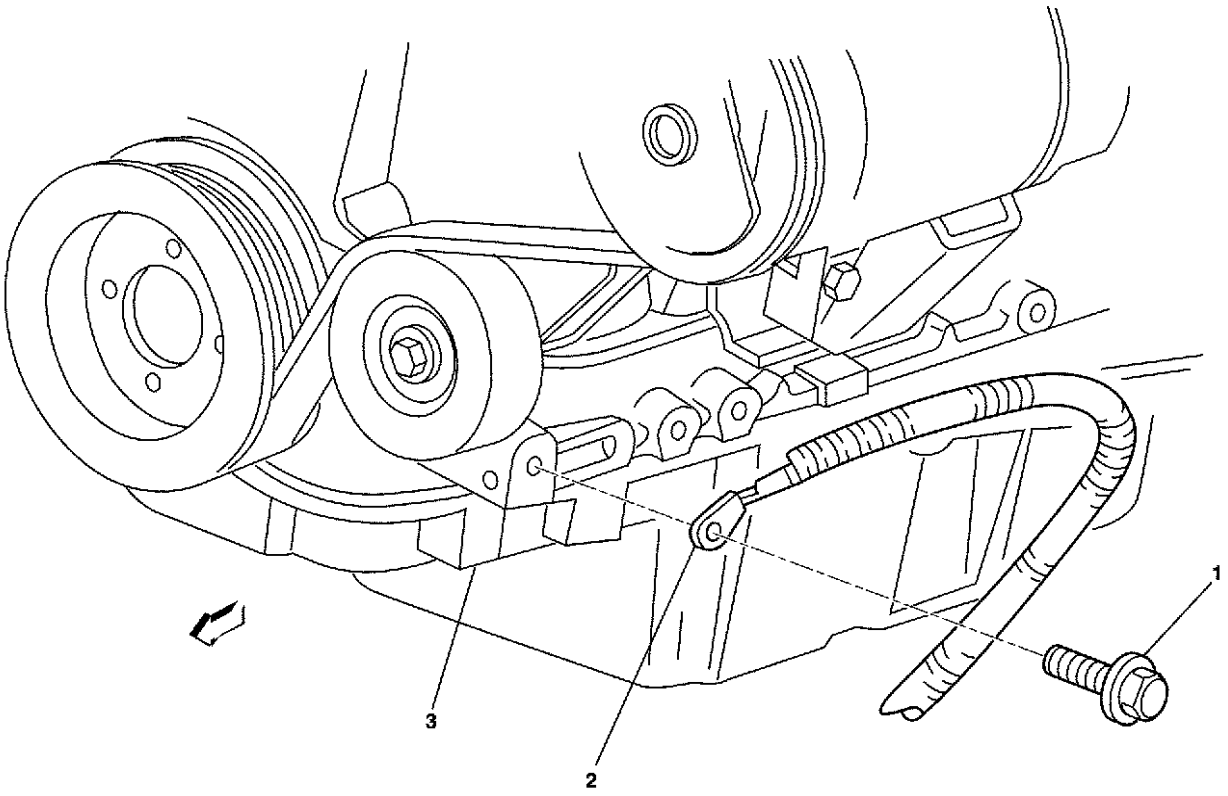
1. Battery Positive Cable (from Battery)
2. Battery and Junction Block Cable Retaining Nut
3. Engine Block
4. Battery Positive Cable to Generator
5. Starter Motor
6. Engine Wiring Harness
7. Starter Motor Solenoid Positive Terminal Stud
8. Engine Wiring Harness Retaining Nut

Engine, Rear (2.4L):



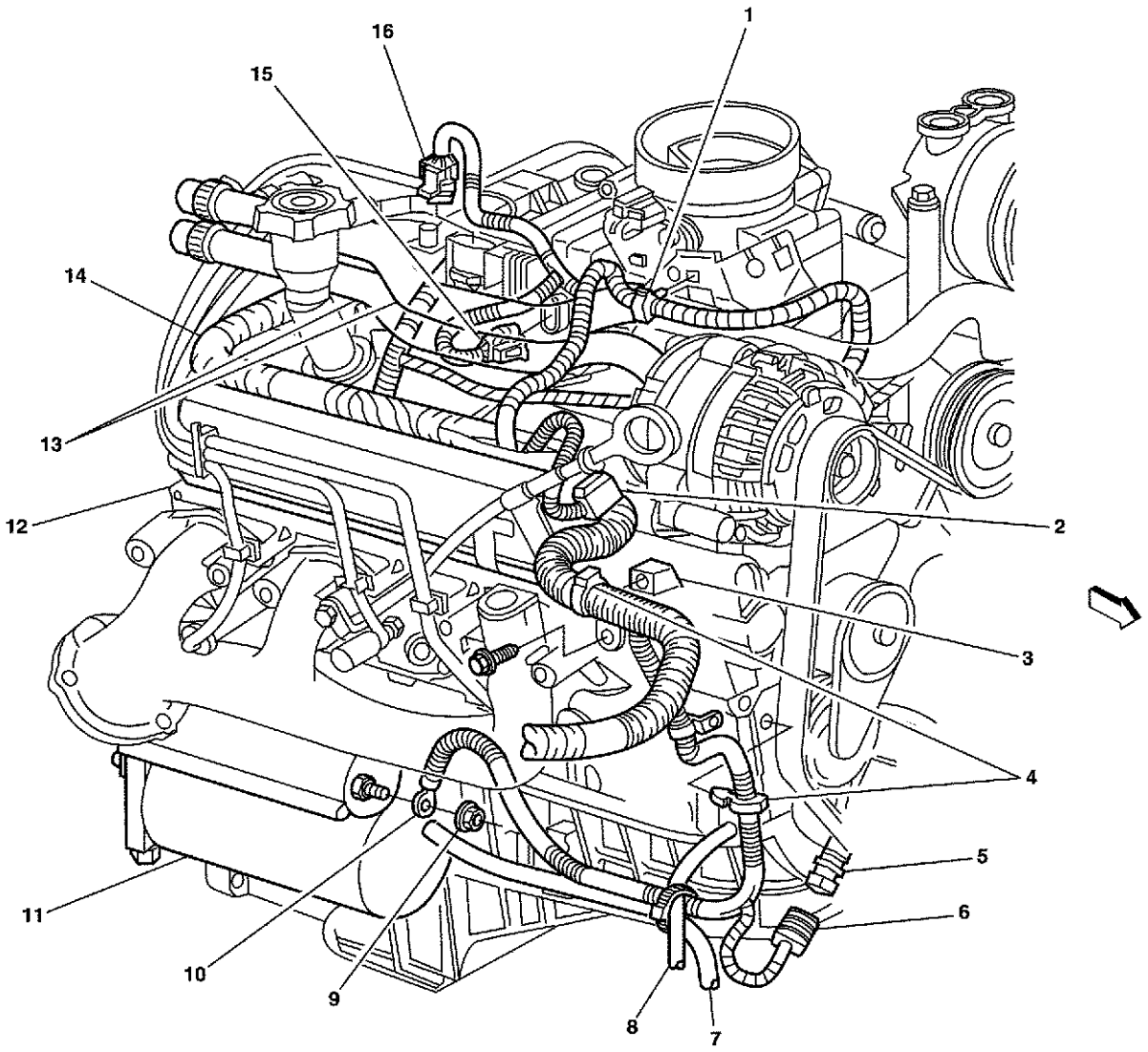
1. Engine
2. Engine Wiring Harness
3. Ground Terminal Retaining Bolt
4. Ground Terminals

Engine, LH Side (2.4L):



1. Battery Negative Cable Retaining Bolt
2. Battery Negative Cable
3. Engine Oil Pan

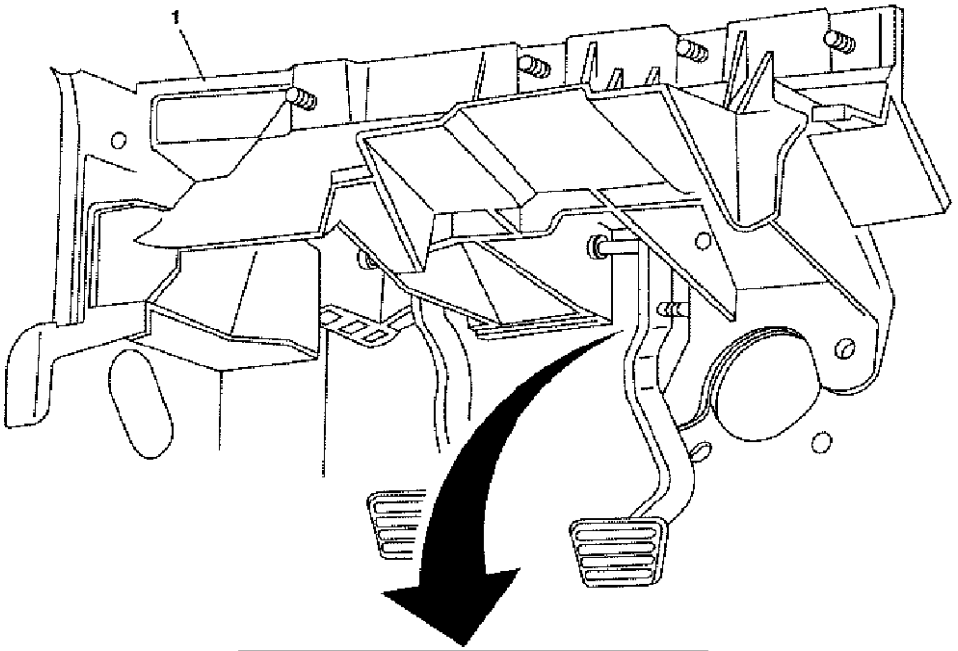
Engine, RH Side (4.3L):

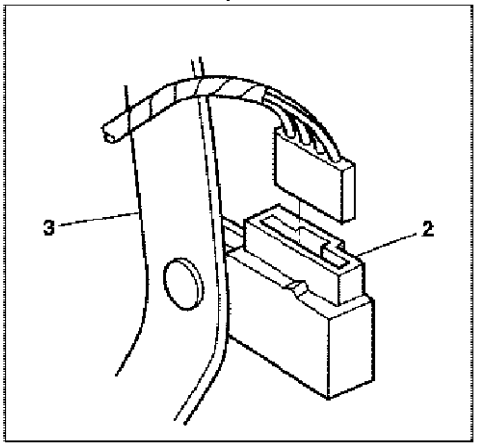


1. Harness Retaining Clip
2. Generator Harness Connector
3. Generator Bracket Mount
4. Harness Retaining Clip
5. Crankshaft Position (CKP) Sensor
6. Crankshaft Position (CKP) Sensor Harness Connector
7. Positive Battery Cable
8. Negative Battery Cable
9. Starter Engine Harness Retaining Nut
10. Starter Engine Harness Terminal
11. Starter Motor
12. Engine Harness Ground Terminals
13. Heater Hoses
14. Engine Harness

15. Ignition Module Harness Connector
16. Ignition Coil Harness Connector

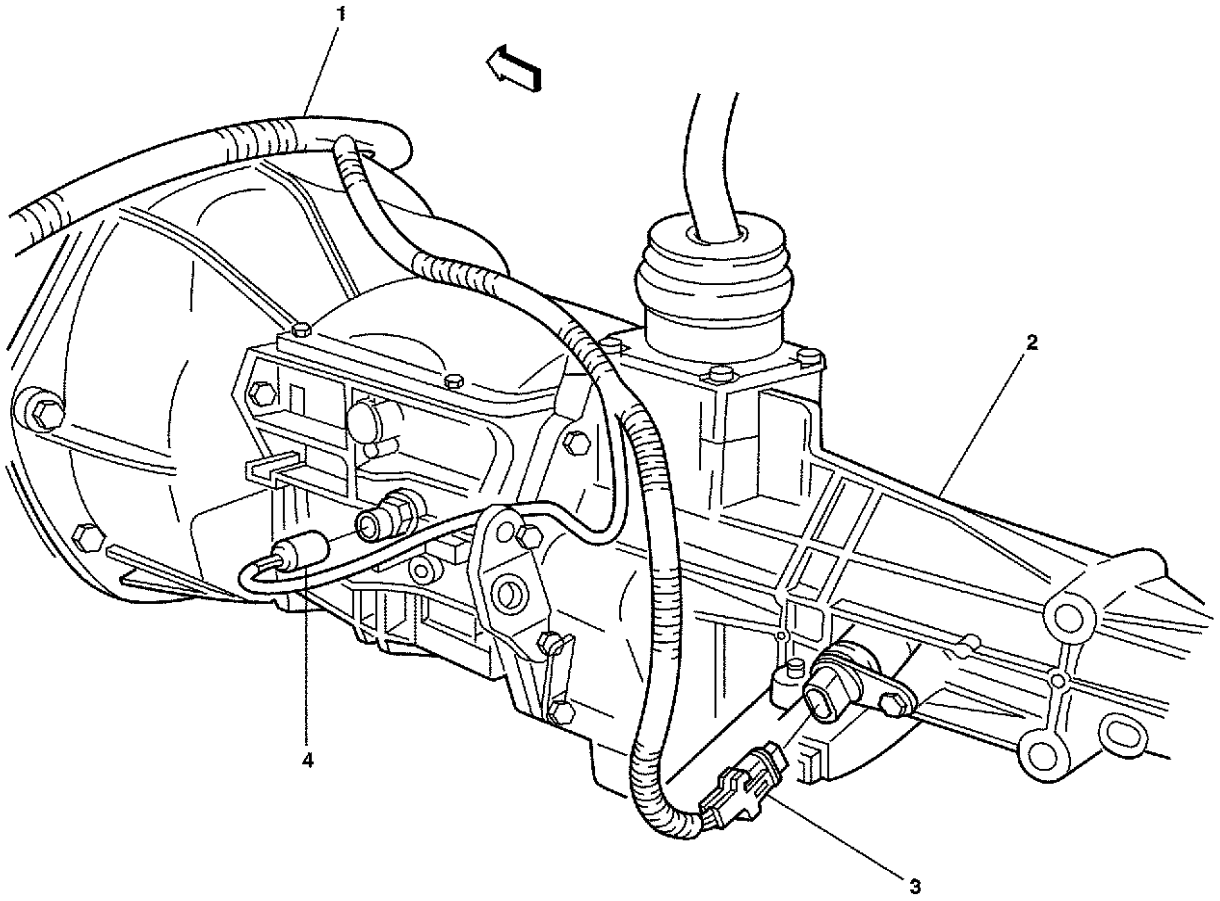
Floor Pedals:





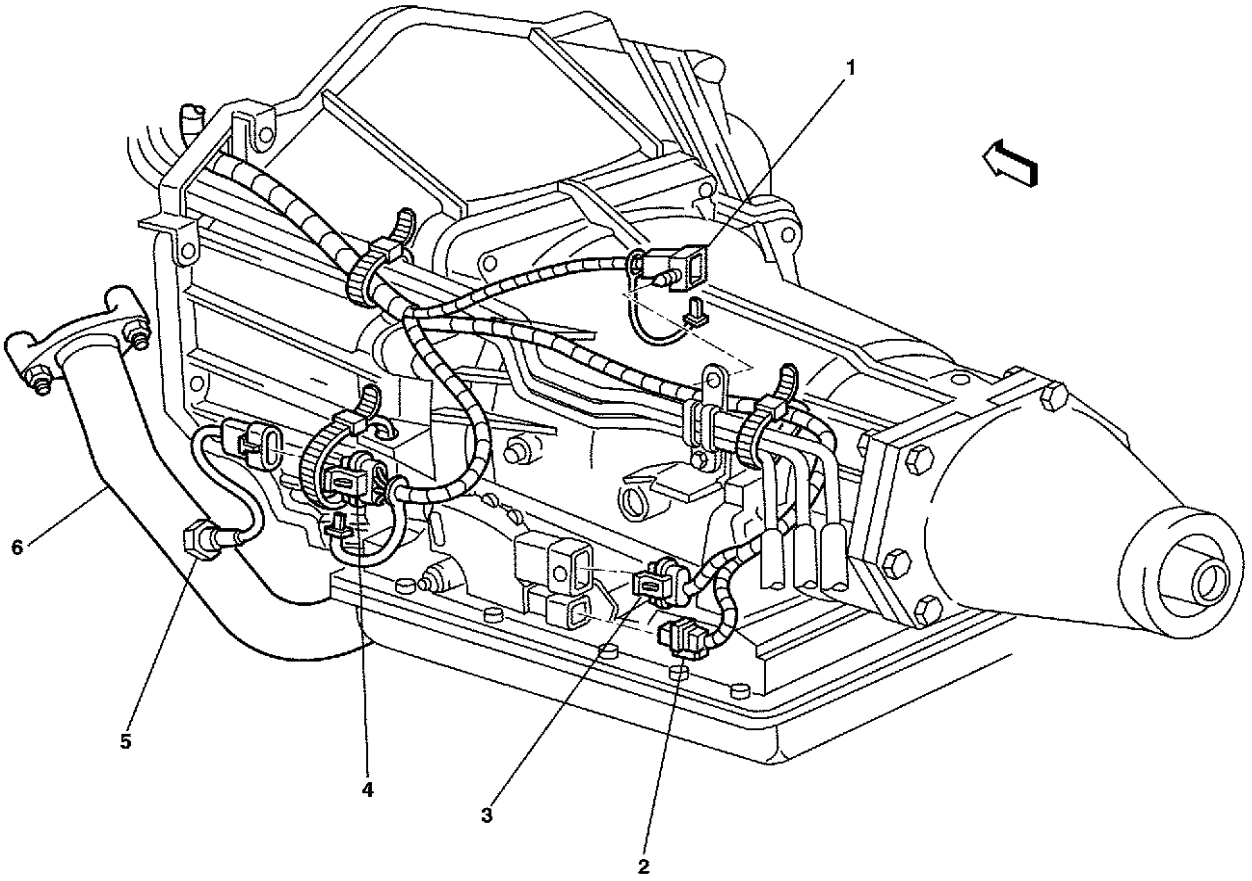
1. Dash Panel
2. Brake Switch
3. Brake Pedal Lever

Manual Transmission Wiring:



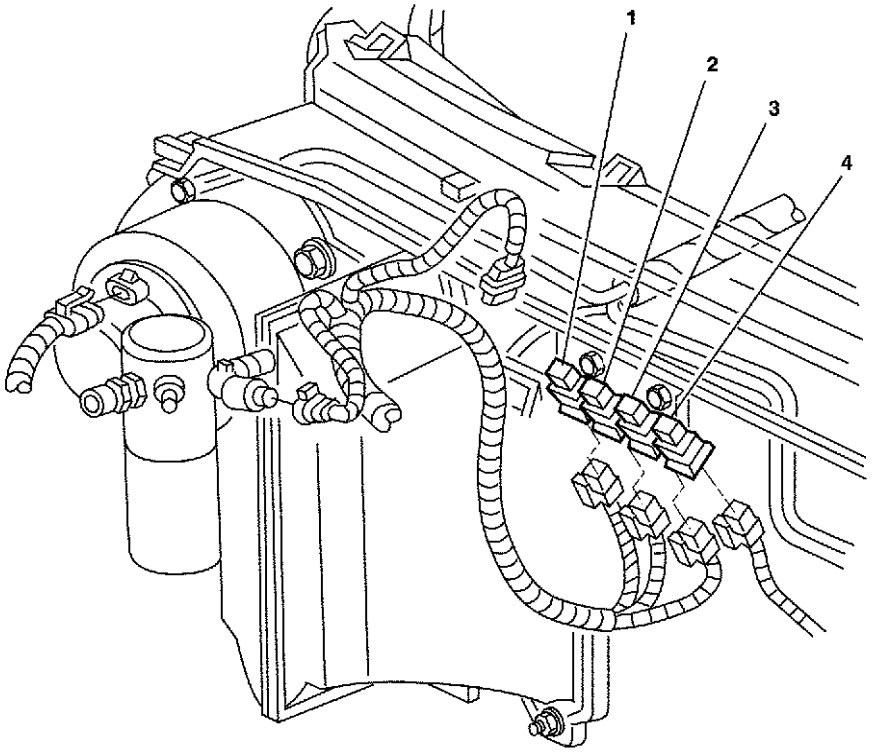
1. Engine Harness
2. Manual Transmission
3. Vehicle Speed Sensor (VSS) Harness Connector
4. Backup Lamp Switch Harness Connector

Transmissi on Range Switch Connector:



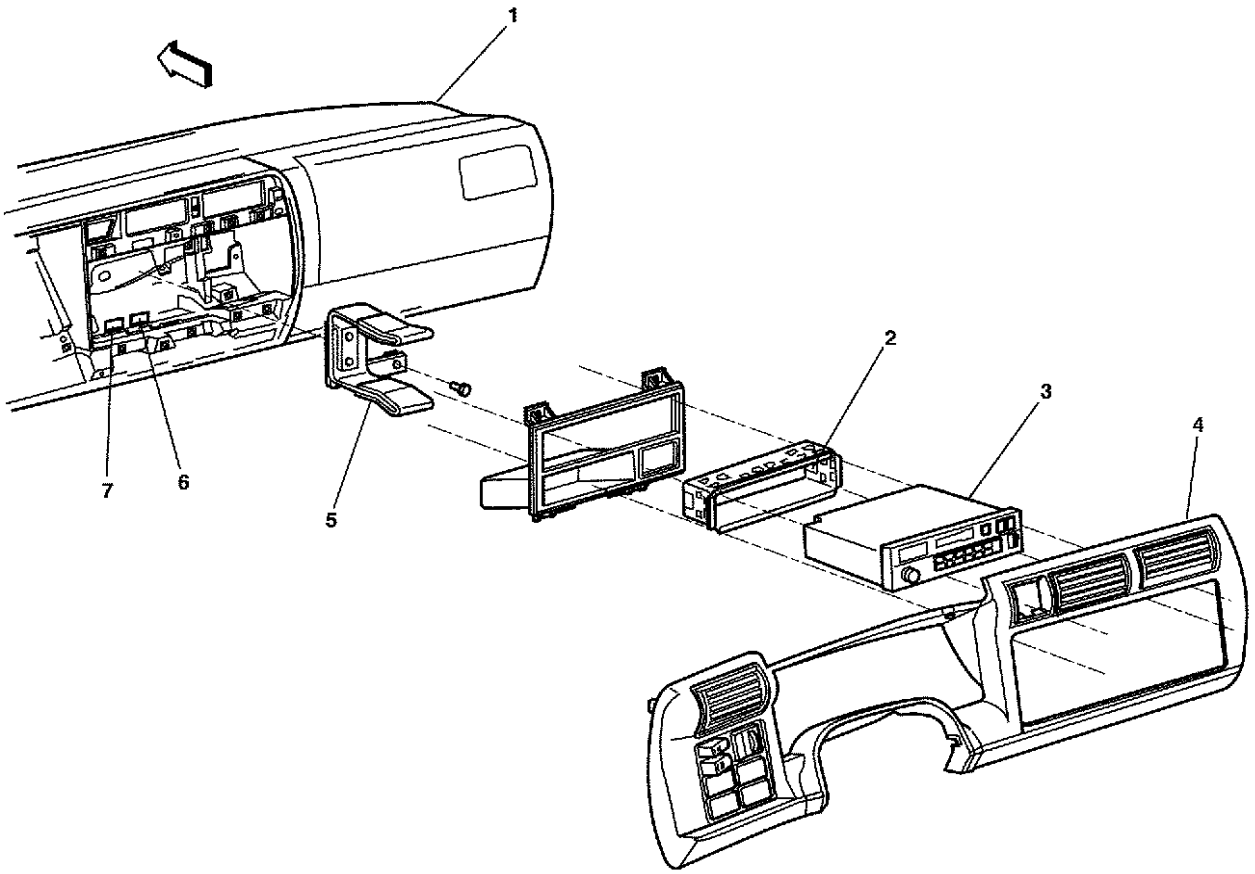
1. Engine Harness to Chassis Harness
2. Transmission Range Switch Connector
3. Transmission Range Switch Connector
4. Heated Oxygen Sensor (HO2S) Harness Connector
5. Heated Oxygen Sensor (HO2S)
6. Left Exhaust Pipe

Relay Locations (4.3L):



1. A/C Clutch Relay
2. Blower Motor Relay
3. Starter Motor Relay
4. ABS Relay

Anti-Theft Relay Location:



1. Instrument Panel
2. Radio Retainer
3. Radio
4. Instrument Panel Cover
5. Radio Bracket
6. Anti-Theft Relay (Deluxe/Luxury Blazer Only)
7. Rear Wiper Relay (Blazer Only)

Component Locator

Engine Electrical Connector End Views

Anti-Theft Relay

Connector Part Information		• 12131311 • 9-Way (BLK)	
Pin	**Wire Color**	**Circuit No.**	**Function**
1	—	—	Not Used
2	YEL	5	Ignition Voltage
3	—	—	Not Used
4	PNK	39	Gauge Fuse 4 Power
5	—	—	Not Used
6	YEL	269	Theft Module Output Signal
7	—	—	Not Used
8	PPL	6	Output Signal to Fuse 20
9	—	—	Not Used

Generator (4.3L)

Connector Part Information		• 15355066 • 2 way F Metri-Pack 150 Series, Sealed (BGE)	
Pin	**Wire Color**	**Circuit No.**	**Function**
A	—	—	Not Used
B	RED	225	Generator Turn On Signal
C-D	—	—	Not Used

Starter Relay (4.3L)

Connector Part Information		• 12110539 • 5-way 280 Series (BLK)	
Pin	**Wire Color**	**Circuit No.**	**Function**
85	BLK	350	Ground
86	YEL	1737	Control Circuit
87	PPL	6	Output to Starter Motor
87A	—	—	Not Used
30	RED	2	Battery Voltage

Diagnostic Information and Procedures

Diagnostic Starting Point - Engine Electrical

Begin the system diagnosis with the **"Diagnostic System Check - Engine Electrical"** . The Diagnostic System Check will provide the following information:

- The identification of the control module(s) which command the system.
- The ability of the control module(s) to communicate through the serial data circuit.
- The identification of any stored diagnostic trouble codes (DTCs) and their status.

The use of the Diagnostic System Check will identify the correct procedure for diagnosing the system and where the procedure is located.

Diagnostic Information and Procedures

Diagnostic System Check - Engine Electrical

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3. Lack of communication may be due to a partial malfunction of the serial data circuit or due to a total malfunction of the serial data circuit. The specified procedure will determine the particular condition.

4. The symptom list in Symptoms will determine the correct diagnostic procedure to use.

Step	Action	Yes	No
1	Perform the Battery Inspection/Test. Refer to **"Battery Inspection/Test"** . Does the battery pass the test?	Go to **Step 2**	Go to **"Battery Inspection/Test"**
2	Install a scan tool.	Go to **Step 3**	Go to **"Scan Tool**

Step	Action	Yes	No
	Does the scan tool power up?		**Does Not Power Up"** in Data Link Communications
3	1. Turn ON the ignition, with the engine OFF. 2. Attempt to communicate with each module on the serial data circuit. Does the scan tool communicate with any module on the serial data circuit?	Go to **Step 4**	Go to **"Scan Tool Does Not Communicate with Class 2 Device"** in Data Link Communications
4	1. Select the Display DTCs function for each module. 2. Record all of the displayed DTCs the DTC status and the module which set the DTC. Does the scan tool display any DTCs?	Go to **"Diagnostic Trouble Code (DTC) List"**	Go to **"Symptoms - Engine Electrical"**

Diagnostic Information and Procedures

Scan Tool Data List

Powertrain Control Module (PCM) Scan Tool Parameter	Data List	Units Displayed	Typical Data Value
Ignition ON/Engine OFF			
Ignition 1 voltage	Engine 1,2	Volts	9–16 V
Generator L Terminal Command	Engine 2	OK/No Output	OK

Diagnostic Information and Procedures

Scan Tool Data Definitions

Ignition 1 Signal: The scan tool displays the current voltage at the battery.
GEN L–Terminal Signal Command: The scan tool displays OK/No Output. The scan tool displays OK until malfunction is detected on the generator L terminal circuit, then it reads No Output.

Diagnostic Information and Procedures

Diagnostic Trouble Code (DTC) List

DTC	Diagnostic Procedure	Modules
48	**"DTC 048 (2.4L)"**	ECM
49	**"DTC 049 (2.4L)"**	ECM
P0562	**"DTC P0562 (4.3L)"**	PCM
P0563	**"DTC P0563 (4.3L)"**	PCM
P1637	**"DTC P1637"**	PCM

Diagnostic Information and Procedures

DTC 048 (2.4L)

Circuit Description

The engine control module (ECM) terminal 37 is the ignition voltage feed circuit. ECM terminal 18 is the battery voltage feed circuit. If the ECM detects a low voltage on ECM terminal 37 for a long time, then DTC 048 sets.

Conditions for Running the DTC

- The ignition is ON.
- The engine coolant temperature (ECT) is at or above 85° C (185°F).

Conditions for Setting the DTC

The engine is running and the ECM voltage is less than 10 volts for 3 minutes.

Action Taken When the DTC Sets

- The ECM stores this information in memory.
- During the time the fault is present, the ECM will lock the 02 control, the idle air control, and the knock control. The ECM will use the last valid values for calculation.

Conditions for Clearing the DTC

Use a Tech 2 scan tool to clear the DTC.

Diagnostic Aids

- Inspect the wiring for faulty electrical conditions at the ECM. Look for the following conditions:
  - A bent terminal
  - A backed out terminal
  - A damaged terminal

- Poor terminal tension
- A chafed wire
- A broken wire inside the insulation
- Moisture intrusion

- When diagnosing for an intermittent, short, or an open condition, wiggle the wiring harness while watching the test equipment for a change.
- Charging the battery with a battery charger may set DTCs. Jump starting an engine may set DTCs.
- If DTCs set when you operate an accessory, inspect the applicable wiring for faulty connections. Inspect the wiring for excessive current draw.
- Inspect the following items for faulty connections.
  - The starter solenoid
  - The fusible link
  - The generator terminals
  - The battery cables
- Inspect the belts for excessive wear. Inspect the belts for proper tension.

Test Description

The number below refers to the step number on the diagnostic table.

2. This step tests the charging system voltage.

4. This step tests ECM battery voltage.

Step	Action	Values	Yes	No
1	Was the On-Board Diagnostic System Check performed?	—	Go to **Step 2**	Go to **"Diagnostic System Check - Engine Electrical"**
2	1. Install the scan tool. 2. With the engine OFF, turn the ignition switch to the RUN position. 3. Record the DTC. 4. Using the J 39200 digital voltmeter (DMM), measure the battery voltage across the battery terminals and record the measurement for future reference. Is the voltage higher than the specified value?	10 V	Go to **Step 3**	Go to **"Battery Inspection/Test"**
3	1. Start the engine. 2. Warm the engine to the operating temperature. Is the generator light ON?	—	Go to **"Charging System Test"**	Go to **Step 4**
4	1. Increase the engine speed to 2,000 RPM for 15 seconds. 2. Observe the DMM battery voltage. Is the DMM battery voltage less than the specified value?	10 V	Go to **"Charging System Test"**	Go to **Step 5**
5	1. Increase the engine speed to 2,000 RPM. 2. Observe the scan tool battery voltage. Is the battery voltage less than the specified value?	10 V	Go to **Step 6**	System OK Go to Diagnostic Aids
6	Replace the ECM. Refer to **"Engine Control Module**	—	Go to **Step 7**	—

Step	Action	Values	Yes	No
	(ECM) Replacement" in Engine Controls – 2.4L. Is the action complete?			
7	In order to verify your repair, perform the following procedure: 1. Start the vehicle. 2. Warm the vehicle to the normal operating temperature. Is the scan tool battery voltage within the specified range?	13.0–15.5 V	System OK	Go to **Step 2**

Diagnostic Information and Procedures

DTC 049 (2.4L)

Circuit Description

The engine control module (ECM) terminal 37 is the ignition voltage feed circuit. ECM terminal 18 is the battery voltage feed circuit. If the ECM detects a high voltage on ECM terminal 37 for a long time, then DTC 049 sets.

Conditions for Running the DTC

- The ignition is ON.
- The engine coolant temperature (ECT) is at or above 85° C (185°F).

Conditions for Setting the DTC

The engine is running and the ECM voltage is more than 16 volts.

Action Taken When the DTC Sets

- The ECM stores this information in memory.
- During the time the fault is present, the ECM will lock the 02 control, the idle air control, and the knock control. The ECM will use the last valid values for calculation.

Conditions for Clearing the DTC

Use a Tech 2 scan tool to clear the DTC.

Diagnostic Aids

- Inspect the wiring for faulty electrical conditions at the ECM. Look for the following conditions:
  - A bent terminal
  - A backed out terminal
  - A damaged terminal
  - Poor terminal tension
  - A chafed wire
  - A broken wire inside the insulation
  - Moisture intrusion
- When diagnosing for an intermittent, short, or an open condition, wiggle the wiring harness while watching the test equipment for a change.
- Charging the battery with a battery charger may set DTCs. Jump starting an engine may set DTCs.
- If DTCs set when you operate an accessory, inspect the applicable wiring for faulty connections. Inspect the wiring for excessive current draw.
- Inspect the following items for faulty connections.
  - The starter solenoid
  - The fusible link
  - The generator terminals
  - The battery cables
- Inspect the belts for excessive wear. Inspect the belts for proper tension.

Test Description

The number below refers to the step number on the diagnostic table.

2. This step tests the charging system voltage.

4. This step tests ECM battery voltage.

Step	Action	Values	Yes	No
1	Did you perform the On-Board Diagnostic System Check?	—	Go to **Step 2**	Go to **"Diagnostic System Check - Engine Electrical"**
2	1. Install the scan tool. 2. With the engine OFF, turn the ignition	10 V	Go to **Step 3**	Go to **"Battery Inspection/Test"**

Step	Action	Values	Yes	No
	switch to the RUN position. 3. Record the DTC. 4. Using the J 39200 digital multimeter (DMM), measure the battery voltage across the battery terminals and record the measurement for future reference. Is the voltage higher than the specified value?			
3	1. Start the engine. 2. Warm the engine to the operating temperature. Is the generator light ON?	—	Go to **"Charging System Test"**	Go to **Step 4**
4	1. Increase the engine speed to 2,000 RPM for 15 seconds. 2. Observe the DMM battery voltage. Is the DMM battery voltage greater than the specified value?	16 V	Go to **"Charging System Test"**	Go to **Step 5**
5	1. Increase the engine speed to 2,000 RPM.	16 V	**Go to Step 6**	System OK Go to Diagnostic Aids
6	Replace the ECM. Refer to **"Engine Control Module (ECM) Replacement"** in Engine Controls – 2.4L. Is the action complete?	—	Go to **Step 7**	—
7	In order to verify your repair, perform the following procedure: 1. Start the vehicle. 2. Warm the vehicle to the normal operating temperature. Is the scan tool battery voltage within the specified range?	13.0–15.5 V	System OK	Go to **Step 2**

Diagnostic Information and Procedures

DTC P0562 (4.3L)

Circuit Description

The PCM monitors the system voltage to make sure that the voltage stays within the proper range. If the PCM detects an excessively low system voltage, DTC P0562 will set.

When the charging system detects a fault, the instrument panel cluster (IPC) battery indicator will light.

Conditions for Running the DTC

- Engine operating
- Engine speed more than 1000 RPM.
- Vehicle speed above 8 km/h (5 mph).
- Engine running for more than 10 seconds.

Conditions for Setting the DTC

The PCM detects an improper voltage on the generator circuit.

Generator output less than 8 volts for 5 seconds.

Action Taken When the DTC Sets

- The PCM stores the DTC information into memory when the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails.
- The PCM disables most outputs.
- The transmission defaults to a predetermined gear.
- The torque converter clutch (TCC) operation is inhibited.
- The malfunction indicator lamp (MIL) will not illuminate.

Conditions for Clearing the DTC

- The Conditions for Setting the DTC are no longer present.
- A history DTC will clear after 40 ignition cycles.
- The Powertrain Control Module (PCM) receives the clear code command from the scan tool.

Test Description

The number below refers to the step number on the diagnostic table.

2. This step verifies that the fault is present.

Step	Action	Values	Yes	No
Schematic Reference: "Starting and Charging Schematics"				
1	Did you perform the Engine Electrical Diagnostic System Check?	—	**Go to Step 2**	Go to **"Diagnostic System Check - Engine Electrical"**
2	With the scan tool monitor the Ignition 1 signal voltage in the PCM data list. Does the scan tool display Ignition 1 voltage greater than the specified value?	8 V	**Go to Step 4**	**Go to Step 3**
3	Test the ignition feed circuit to the PCM for high resistance or open. Refer to **"Circuit Testing"** and **"Wiring Repairs"** in Wiring Systems. Did you find and correct the condition?	—	**Go to Step 7**	**Go to Step 5**
4	1. Inspect for poor connections at the PCM. Refer to **"Testing for Intermittent and Poor Connections"** in Wiring Systems. 2. If you find a poor connection, repair the condition as necessary. Refer to **"Wiring Repairs"** in Wiring Systems. Did you find and correct the condition?	—	**Go to Step 7**	**Go to Step 6**
5	Repair the ignition feed circuit to the PCM for an open or a short to ground. Refer to **"Wiring Repairs"** in Wiring Systems. Is the action complete?	—	**Go to Step 7**	—
6	**Important:** The replacement PCM must be programmed. Replace the PCM. Refer to **"Powertrain Control Module (PCM) Replacement"** in Engine Controls – 4.3L. Is the action complete?	—	**Go to Step 7**	—
7	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the DTC reset?	—	**Go to Step 2**	System OK

Diagnostic Information and Procedures

DTC P0563 (4.3L)

Circuit Description

The powertrain control module (PCM) continuously monitors the system voltage. The PCM monitors the system voltage to make sure that the voltage stays within the proper range. If the PCM detects an excessively high system voltage, DTC P0563 will set. A high voltage condition may cause a stalling condition or other driveability concerns.

Conditions for Running the DTC

The engine is operating.

Conditions for Setting the DTC

- The PCM senses the system voltage is above 18 volts.
- All of the conditions are present for 5 seconds.

Action Taken When the DTC Sets

- The PCM stores DTC P0563 in the PCM memory when the diagnostic runs and fails.
- The PCM will record the operating conditions at the time the diagnostic fails.
- The PCM disables most outputs.
- The transmission defaults to a predetermined gear.
- The torque converter clutch (TCC) operation is inhibited.
- The instrument panel cluster (IPC) displays a message.
- The malfunction indicator lamp (MIL) will not illuminate.

Conditions for Clearing the DTC

- The Conditions for Setting the DTC are no longer present.
- A history DTC will clear after 40 ignition cycles.
- The Powertrain Control Module (PCM) receives the clear code command from the scan tool.

Diagnostic Aids

Refer to **"Testing for Intermittent and Poor Connections"** in Wiring Systems. This could cause an intermittent overcharging condition. Refer to **"Circuit Testing"** and **"Wiring Repairs"** in Wiring Systems.

Test Description

The number below refers to the step number on the diagnostic table.

2. This step tests for excessive generator output. The voltage should remain below 18 volts.

Step	Action	Values	Yes	No
Schematic Reference: "Starting and Charging Schematics"				
1	Did you perform the Engine Electrical Diagnostic System Check?	—	**Go to Step 2**	Go to **"Diagnostic System Check - Engine Electrical"**
2	1. Turn OFF all the accessories. 2. Measure the battery voltage at the battery using the DMM . 3. Operate the engine speed above 2,000 RPM. Is the battery voltage less than the specified value?	18 V	**Go to Step 4**	**Go to Step 3**
3	Replace the generator. Refer to **"Generator Replacement (2.4L)" "Generator Replacement (4.3L)"** . Is the action complete?	—	**Go to Step 5**	—
4	**Important:** The replacement PCM must be programmed. Replace the PCM. Refer to **"Powertrain Control Module (PCM) Replacement"** in Engine Controls – 4.3L. Is the action complete?	—	**Go to Step 5**	—
5	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the DTC reset?	—	**Go to Step 2**	System OK

Diagnostic Information and Procedures

DTC P1637

Circuit Description

The powertrain control module (PCM) continuously monitors the system voltage. A voltage below 8 volts or above 18 volts causes improper system operation or component damage. The PCM operates in a default mode if a PCM voltage DTC sets. The PCM disables most outputs if the system voltage is high. A scan tool may not display data if system voltage is below 8 volts. A low voltage condition may cause a stalling condition or other driveability concerns.

Conditions for Running the DTC

- The ignition is ON.
- The engine speed is more than 1000 RPM.

Conditions for Setting the DTC

- The PCM detects the GEN L–Terminal active with the ignition ON.
- The PCM detects the GEN L–Terminal inactive with the engine operating.
- The above conditions are present for 6 seconds.

Action Taken When the DTC Sets

- The PCM stores DTC P1637 in memory when the diagnostic runs and fails.
- The PCM will record the operating conditions at the time the diagnostic fails. The PCM stores this information in Failure Records.
- The instrument panel cluster (IPC) displays a message.
- The malfunction indicator lamp (MIL) will not illuminate.

Conditions for Clearing the DTC

- The Conditions for Setting the DTC are no longer present.
- A history DTC will clear after 40 malfunction free ignition cycles.
- The Powertrain Control Module (PCM) receives the clear code command from the scan tool.

Diagnostic Aids

- An extremely low voltage, such as below 7.5 volts, may cause the loss of serial data and the MIL may not function. An open ignition feed circuit causes a no start and the MIL will not illuminate. A low system voltage may cause other DTCs to set.
- Using Freeze Frame and Failure Records data may aid in locating an intermittent condition.

Test Description

The number below refers to the step number on the diagnostic table.

2. This step determines if a fault is present.

4. A poor connection at the generator causes no output.

Step	Action	Value(s)	Yes	No
Schematic Reference: "Starting and Charging Schematics"				
1	Did you perform the Engine Electrical Diagnostic System Check?	—	Go to **Step 2**	Go to **"Diagnostic System Check - Engine Electrical"**
2	1. Install a scan tool. 2. Idle the engine. 3. Monitor the generator L-terminal parameter using a scan tool. Does the scan tool display the generator L-terminal as Inactive?	—	Go to **Step 3**	Go to **Step 4**
3	Probe the generator battery feed circuit using the test lamp connected to ground. Refer to **"Troubleshooting with a Test Lamp"** in Wiring Systems. Does the test lamp illuminate?	—	Go to **Step 4**	Go to **"Testing for Intermittent and Poor Connections"** in Wiring Systems
4	Inspect the terminal contact tension at the generator electrical connector. Refer to **"Circuit Testing"** and **"Wiring Repairs"** in Wiring Systems. Did you find and correct the condition?		Go to **Step 11**	Go to **Step 5**
5	1. Turn OFF the ignition. 2. Disconnect the PCM connector C164. Refer to **"Powertrain Control Module (PCM) Replacement"** in Engine Controls–4.3 L. 3. Test for a high resistance or open in the generator circuit at the PCM harness connector to the B terminal of the generator harness connector using the DMM J 39200 . Refer to **"Testing for Continuity"** in Wiring	—	Go to **Step 6**	Go to **Step 8**

Step	Action	Value(s)	Yes	No
	Systems . Does the DMM indicate continuity?			
6	Test or a high resistance or open in the generator circuit from terminal B at the generator harness connector to battery ground using the DMM. Refer to **"Testing for Continuity"** in Wiring Systems . Does the DMM indicate continuity?	—	Go to **Step 7**	Go to **Step 9**
7	Inspect the terminal contact tension at the PCM harness connector. Refer to **"Testing for Intermittent and Poor Connections"** in Wiring Systems . Did you find and correct the condition?	—	Go to **Step 13**	Go to **Step 9**
8	Repair the open or high resistance in the generator circuit. Refer to **"Wiring Repairs"** in Wiring Systems . Is the repair complete?	—	Go to **Step 13**	—
9	Repair the short to ground in the generator circuit. Refer to **"Wiring Repairs"** in Wiring Systems. Is the repair complete?	—	Go to **Step 13**	
10	**Important::** Program the replacement PCM. Replace the PCM. Refer to **"Powertrain Control Module (PCM) Replacement"** in Engine Controls–4.3 L. Is the action complete?	—	Go to **Step 13**	—
11	1. Remove the electrical connector from the generator. 2. Start the engine. 3. Measure the voltage to ground at the generator harness connector terminal B using the DMM. Refer to **"Measuring Voltage"** in Wiring Systems. Is the voltage the same as or more than the specified value?	10 V	Go to **Step 13**	Go to **Step 12**
12	Replace the generator. Refer to **"Generator Replacement (2.4L)"** **"Generator Replacement (4.3L)"** . Is the action complete?	—	Go to **Step 13**	—
13	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Operate the vehicle within the Conditions for Running this DTC as specified in the supporting text, if applicable. Does the DTC reset?	—	System OK	Go to **Step 2**

Diagnostic Information and Procedures

Symptoms - Engine Electrical

Important: The following steps must be completed before using the symptom tables.

- Perform **"Diagnostic System Check - Engine Electrical"** before using the Symptom Tables in order to verify that all of the following are true:
  - There are no DTCs set.
  - The control module(s) can communicate via the serial data link.
  - The anti-theft system is working properly (Deluxe and Luxury Blazer only).
- Review the system operation in order to familiarize yourself with the system functions. Refer to one of the following system operations:
  - **"Battery Description and Operation"**
  - **"Starting System Description and Operation"**
  - **"Charging System Description and Operation"**

Visual/Physical Inspection

- Inspect for aftermarket devices which could affect the operation of the Starting and Charging Systems. Refer to **"Checking Aftermarket Accessories"** in Wiring Systems.
- Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.

Intermittent

Faulty electrical connections or wiring may be the cause of intermittent conditions. Refer to **"Testing for Intermittent and Poor Connections"** in Wiring Systems.

Symptom List

Refer to a symptom diagnostic procedure from the following list in order to diagnose the symptom:

- **"Starter Solenoid Does Not Click (4.3L)" "Starter Solenoid Does Not Click (2.4L)"**
- **"Starter Solenoid Clicks, Engine Does Not Crank"**
- **"Engine Cranks Slowly"**
- **"Battery Inspection/Test"**
- **"Charge Indicator Always On"**
- **"Charge Indicator Inoperative"**
- **"Charging System Test"**
- **"Generator Noise Diagnosis"**

Diagnostic Information and Procedures

Starter Solenoid Does Not Click (4.3L)

Step	Action	Yes	No
Schematic Reference: "Starting and Charging Schematics"			
1	Did you perform the Engine Electrical Diagnostic System Check?	**Go to Step 2**	Go to **"Diagnostic System Check - Engine Electrical"**
2	Turn the ignition switch to the START position. Does the engine crank?	Go to **"Testing for Intermittent and Poor Connections"** in Wiring Systems	**Go to Step 3**
3	Turn the ignition switch to the START position. Does the starter motor relay click?	**Go to Step 7**	**Go to Step 4**
4	1. Remove the starter motor relay. 2. Connect a test light from the supply voltage circuit of the starter motor relay coil circuit to ground. 3. With the transmission in park, turn the ignition switch to the START position. Does the test light illuminate?	**Go to Step 5**	**Go to Step 6**
5	1. Connect a test light from the supply voltage circuit of the starter motor relay coil circuit to the control circuit of the starter motor relay coil circuit. 2. With the transmission in park, turn the ignition switch to the START position. Does the test light illuminate?	**Go to Step 13**	**Go to Step 10**
6	1. Turn OFF the ignition. 2. Disconnect the Park Neutral Position (PNP) switch. Refer to **"Park/Neutral Position Switch Replacement"** in Automatic Transmission – 4L60–E. 3. Turn ON the ignition, with the engine OFF. 4. Connect a 10 amp fused jumper	**Go to Step 14**	**Go to Step 11**

Step	Action	Yes	No
	between the starter motor relay coil control circuits of the PNP switch. 5. With the transmission in park, turn the ignition switch to the START position. Does the test lamp illuminate?		
7	1. Turn OFF the ignition. 2. Remove the starter motor relay. 3. Connect a test lamp between the battery positive voltage circuit of the starter motor relay switch circuit and a good ground. Does the test lamp illuminate?	**Go to Step 8**	**Go to Step 17**
8	Connect a 30 amp fused jumper between the battery positive voltage circuit of the starter motor relay switch circuit and the supply voltage circuit of the starter solenoid. Does the engine crank?	**Go to Step 13**	**Go to Step 9**
9	Does the fuse in the jumper open?	**Go to Step 18**	**Go to Step 12**
10	Test the control circuit of the starter motor relay for an open or high resistance. Refer to **"Circuit Testing"** and **"Wiring Repairs"** in Wiring Systems. Did you find and correct the condition?	**Go to Step 23**	**Go to Step 19**
11	Test the supply voltage circuit of the starter motor relay coil circuit for an open or high resistance. Refer to **"Circuit Testing"** and **"Wiring Repairs"** in Wiring Systems. Did you find and correct the condition?	**Go to Step 23**	**Go to Step 15**
12	Test the supply voltage circuit of the starter solenoid for an open or high resistance. Refer to **"Circuit Testing"** and **"Wiring Repairs"** in Wiring Systems. Did you find and correct the condition?	**Go to Step 23**	**Go to Step 16**
13	Inspect for poor connections at the starter motor relay. Refer to **"Testing for Intermittent and Poor Connections"** and **"Connector Repairs"** in Wiring Systems. Did you find and correct the condition?	**Go to Step 23**	**Go to Step 19**
14	1. Inspect for a poor connection at the PNP switch harness connector. Refer to **"Testing for Intermittent and Poor Connections"** and **"Connector Repairs"** in Wiring Systems. 2. If OK, adjust the PNP switch. Refer to **"Park/Neutral Position Switch Adjustment"** in Automatic Transmission – 4L60–E. Did you find and correct the condition?	**Go to Step 23**	**Go to Step 20**
15	Inspect for poor connections at the ignition switch harness connector. Refer to **"Testing for Intermittent and Poor Connections"** and **"Connector Repairs"** in Wiring Systems. Did you find and correct the condition?	**Go to Step 23**	**Go to Step 21**
16	Inspect for poor connections at the starter solenoid. Refer to **"Testing for Intermittent and Poor Connections"** and **"Connector Repairs"** in Wiring Systems. Did you find and correct the condition?	**Go to Step 23**	**Go to Step 22**
17	Repair the open or high	**Go to Step 23**	—

Step	Action	Yes	No
	resistance in the battery positive voltage circuit of the starter motor relay switch circuit. Refer to **"Wiring Repairs"** in Wiring Systems. Did you complete the repair?		
18	Repair the short to ground in the supply voltage circuit of the starter solenoid. Refer to **"Wiring Repairs"** in Wiring Systems. Did you complete the repair?	**Go to Step 23**	—
19	Replace the starter motor relay. Did you complete the replacement?	**Go to Step 23**	—
20	Replace the PNP switch. Refer to **"Park/Neutral Position Switch Replacement"** in Automatic Transmission – 4L60–E. Did you complete the replacement?	**Go to Step 23**	—
21	Replace the Ignition Switch. Refer to **"Ignition Switch Replacement - On Vehicle"** (Tilt Column) or **"Ignition Switch Replacement - On Vehicle"** (Standard Column) in Steering Wheel and Column. Did you complete the replacement?	**Go to Step 23**	—
22	Replace the starter. Refer to **"Starter Motor Replacement (2.4L)" "Starter Motor Replacement (4.3L)"** . Did you complete the replacement?	**Go to Step 23**	—
23	Operate the system for which the symptom occurred. Did you correct the condition?	System OK	**Go to Step 2**

Diagnostic Information and Procedures

Starter Solenoid Does Not Click (2.4L)

Step	Action	Yes	No
Schematic Reference: Starting and Charging Schematics			
1	Did you review the following and perform the necessary inspections?	Go to **Step 2**	Go to **"Symptoms - Engine**

Step	Action	Yes	No
	• **"Battery Description and Operation"** • **"Starting System Description and Operation"** • **"Charging System Description and Operation"**		**Electrical"**
2	Turn the ignition to the START position. Does the starter solenoid click?	Go to **Step 4**	Go to **Step 3**
3	1. Turn OFF the ignition. 2. Disconnect the starter solenoid crank voltage circuit from the starter solenoid. 3. Connect a test lamp between the starter solenoid crank voltage circuit of the starter solenoid and a good ground. 4. Turn the ignition to the START position. Did the test lamp illuminate?	Go to **Step 4**	Go to **Step 5**
4	Inspect for poor connection at starter solenoid. Refer to **"Testing for Intermittent and Poor Connections"** and **"Connector Repairs"** in Wiring Systems. Did you find and correct the condition?	Go to **Step 9**	Go to **Step 7**
5	Inspect for poor connection at the ignition switch. Refer to **"Testing for Intermittent and Poor Connections"** and **"Connector Repairs"** in Wiring Systems. Did you find and correct the condition?	Go to **Step 9**	Go to **Step 6**
6	Check for high resistance or open in the starter solenoid crank voltage circuit. Refer to **"Wiring Repairs"** in Wiring Systems. Did you find and correct the condition?	Go to **Step 9**	Go to **Step 8**
7	Replace the starter. Refer to **"Starter Motor Replacement (2.4L)" "Starter Motor Replacement (4.3L)"** . Did you complete the replacement?	Go to **Step 9**	—
8	Replace the ignition switch. Refer to **"Ignition Switch Replacement - On Vehicle"** in Steering Wheel and Column - Standard or **"Ignition Switch Replacement - On Vehicle"** in Steering Wheel and	Go to **Step 9**	—

Step	Action	Yes	No
	Column - Tilt. Did you complete the replacement?		
9	Operate the system for which the symptom occurred. Did you correct the condition?	System OK	Go to **Step 3**

Diagnostic Information and Procedures

Starter Solenoid Clicks, Engine Does Not Crank

Step	Action	Yes	No
Schematic Reference: Starting and Charging Schematics			
1	Did you perform the Engine Electrical Diagnostic System Check?	Go to **Step 2**	Go to **"Diagnostic System Check - Engine Electrical"**
2	Turn the ignition to the START position. Did the starter solenoid click?	Go to **Step 3**	Go to **"Starter Solenoid Does Not Click (4.3L)" "Starter Solenoid Does Not Click (2.4L)"**
3	Inspect the engine and belt drive system for mechanical binding (seized engine, seized generator). Does the engine move freely?	Go to **Step 4**	Go to **"Engine Will Not Crank - Crankshaft Will Not Rotate"**
4	Test the battery positive cable between the battery and the starter solenoid for high resistance. Refer to **"Circuit Testing"** and **"Wiring Repairs"** in Wiring Systems. Did you find and correct the condition?	Go to **Step 8**	Go to **Step 5**
5	Test the ground circuit between the battery and the starter motor for a high resistance. Refer to **"Circuit Testing"** and **"Wiring Repairs"** in Wiring Systems. Did you find and correct the condition?	Go to **Step 8**	Go to **Step 6**
6	Inspect for poor connections at the starter. Refer to **"Testing for Intermittent and Poor Connections"** and **"Connector Repairs"** in Wiring Systems. Did you find and correct the condition?	Go to **Step 8**	Go to **Step 7**
7	Replace the Starter. Refer to **"Starter Motor Replacement (2.4L)" "Starter Motor Replacement (4.3L)"** . Did you complete the replacement?	Go to **Step 8**	—
8	Operate the system for which the symptom occurred. Did you correct the condition?	System OK	Go to **Step 2**

Diagnostic Information and Procedures

Engine Cranks Slowly

Perform the following checks:

- Battery — Battery Inspection/Test. Refer to **"Battery Inspection/Test"** .
- Wiring — Inspect the wiring for damage. Inspect all connections to the starter motor, solenoid, battery, and all ground connections. Refer to **"Circuit Testing"** , **"Wiring Repairs"** , **"Testing for Intermittent and Poor Connections"** and **"Connector Repairs"** in Wiring Systems.
- Engine — Make sure the engine is not seized. Refer to **"Symptoms - Engine Mechanical"** 2.4L or **"Symptoms - Engine Mechanical"** 4.3L.

If the battery, the wiring and the engine are functioning properly and the engine continues to crank slowly, replace the starter motor. Refer to **"Starter Motor Replacement (2.4L)" "Starter Motor Replacement (4.3L)"** .

Diagnostic Information and Procedures

Charge Indicator Always On

Step	Action	Yes	No
1	Did you perform the Engine Electrical Diagnostic System Check?	Go to **Step 2**	Go to **"Diagnostic System Check - Engine Electrical"**
2	1. Turn ON the ignition, with the engine OFF. 2. Observe the Charge indicator on the instrument cluster (IPC) Does the charge indicator illuminate?	Go to **Step 3**	Go to **"Testing for Intermittent and Poor Connections"** in Wiring Systems
3	1. Turn OFF the ignition. 2. Disconnect the generator connector. 3. Turn ON the ignition, with the engine OFF. Does the charge indicator remain illuminated?	Go to **Step 4**	Go to **Step 5**
4	Test the charge indicator control circuit for a short to	Go to **Step 7**	Go to **Step 6**

Step	Action	Yes	No
	ground. Refer to **"Circuit Testing"** and **"Wiring Repairs"** in Wiring Systems. Did you find and correct the condition?		
5	Replace the generator. Refer to **"Generator Replacement (2.4L)" "Generator Replacement (4.3L)"** . Did you complete the replacement?	Go to **Step 7**	—
6	Replace the instrument panel cluster (IPC) assembly. Refer to **"Instrument Panel Cluster (IPC) Replacement"** in Instrument Panel, Gauges and Console. Did you complete the replacement?	Go to **Step 7**	—
7	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 3**

Diagnostic Information and Procedures

Charge Indicator Inoperative

Step	Action	Yes	No
1	Did you perform the Engine Electrical Diagnostic System Check?	Go to **Step 2**	Go to **"Diagnostic System Check - Engine Electrical"**
2	Turn ON the ignition, with the engine OFF observe the Charge indicator on the instrument cluster (IPC) Is the charge indicator illuminated?	Go to **"Testing for Intermittent and Poor Connections"** in Wiring Systems	Go to **Step 3**
3	1. Turn OFF the ignition. 2. Disconnect the generator connector. 3. Connect a 3 amp fused jumper wire between the charge indicator control circuit and a good ground. 4. Turn ON the ignition, with the engine OFF. Does the charge indicator	Go to **Step 4**	Go to **Step 5**
	remain OFF?		
4	Test the Charge indicator control circuit for an open or high resistance. Refer to **"Circuit Testing"** and **"Wiring Repairs"** in Wiring Systems. Did you find and correct the condition?	Go to **Step 9**	Go to **Step 7**
5	Inspect for poor connections at the harness connector of the generator. Refer to **"Circuit Testing"** and **"Wiring Repairs"** in Wiring Systems. Did you find and repair the condition?	Go to **Step 9**	Go to **Step 6**
6	Replace the generator. Refer to **"Generator Replacement (2.4L)" "Generator Replacement (4.3L)"** . Did you compete the replacement?	Go to **Step 9**	—
7	1. Remove the instrument panel cluster (IPC). Refer to **"Instrument Panel Cluster (IPC) Replacement"** in Instrument Panel, Gauges and Console. 2. Inspect the charge indicator bulb. 3. Replace the bulb if faulty. Did you correct the condition?	Go to **Step 9**	Go to **Step 8**
8	Replace the instrument panel cluster (IPC) assembly. Refer to **"Instrument Panel Cluster (IPC) Replacement"** in Instrument Panel, Gauges and Console. Did you complete the replacement?	Go to **Step 9**	—
9	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 3**

Diagnostic Information and Procedures

Battery Inspection/Test

Diagnostic Aids

Caution: Refer to "Battery Disconnect Caution" in Cautions and Notices.

Important: The battery test using the J 42000 Battery Tester requires correct connections to the battery terminals. A failure to obtain the correct connections during the test may result in a failed test on a good battery.

Adhere to the following instructions in order to avoid an incorrect diagnosis due to poor connections:

- When testing the vehicle with the battery cables still connected, rock the J 42000 clips back and forth on the terminal bolt in order to cut through any coating or oxidation that may be present on the bolt.

  Even new bolts contain a protective coating that may insulate or cause a resistance in the test circuit.

- If it is uncertain that correct connections can be made to the battery terminal bolts in the vehicle, perform the following steps:

  1. Disconnect the negative battery cable.
  2. Disconnect the positive battery cable.
  3. Install the test adapters on the terminals.
  4. Follow the instructions for testing the battery outside of the vehicle.

- If a REPLACE BATTERY result is obtained for a battery that is below 4° C (40° F), perform the following steps:

  1. Disconnect the negative battery cable.
  2. Disconnect the positive battery cable.
  3. Allow the battery to sit in a warm place (above 15°C (60°F) for 6 hours.
  4. Install the approved adapters.
  5. Follow the instructions for testing the battery outside of the vehicle.
  6. Replace the battery only if the second test shows a REPLACE BATTERY result.

     For warranty purposes, use the test code from the second test.

- If a REPLACE BATTERY result is obtained for a battery tested in the vehicle with the battery cables connected, perform the following steps:

  1. Disconnect the negative battery cable.
  2. Disconnect the positive battery cable.
  3. Install the approved adapters.
  4. Follow the instructions for testing the battery outside of the vehicle.
  5. Replace the battery only if the second test shows a REPLACE BATTERY result.

     For warranty purposes, use the test code from the second test.

- Use the approved terminal adapters.

  Do not use any common bolts or a combination of bolts, nuts, and washers as adapters when testing the battery.

  Use the test adapters that are provided with the J 42000 tester or JBGM P/N 12303040 terminal adapters. If the adapters that are provided with the J 42000 tester require replacement, only use adapters with the JBGM P/N 12303040. Any other adapter may not contact the correct areas of the battery terminal, causing a resistance that may result in an invalid battery test result.

Important: For warranty purposes, always place the test code displayed by the tester on the repair order. The number is a unique identifier that describes the test data for a particular battery at a particular time. While the test code may occasionally repeat when retesting the same battery, it is more likely that a different code will result each time the battery is tested.

Step	Action	Value(s)	Yes	No
1	Inspect the battery for a cracked, broken, or damaged case, which may indicated by battery acid leakage. Is the battery OK?	—	Go to **Step 2**	Go to **Step 19**
2	Compare the Cold Cranking Amperage (CCA) and Reserve Capacity (RC) of the battery to the original battery or Original Equipment (OE) specification. Refer to **"Battery Usage"** . Does the battery meet or exceed the specifications?	—	Go to **Step 3**	Go to **Step 19**
3	Does the hydrometer display a yellow dot?	—	Go to **Step 4**	Go to **Step 5**
4	Tap the hydrometer lightly on top with the handle of a small screwdriver to dislodge any air bubbles inside the battery. Does the hydrometer still display a yellow dot?	—	Go to **Step 19**	Go to **Step 5**
5	1. Turn OFF the ignition.	—	Go to **Step 6**	Go to **Step**

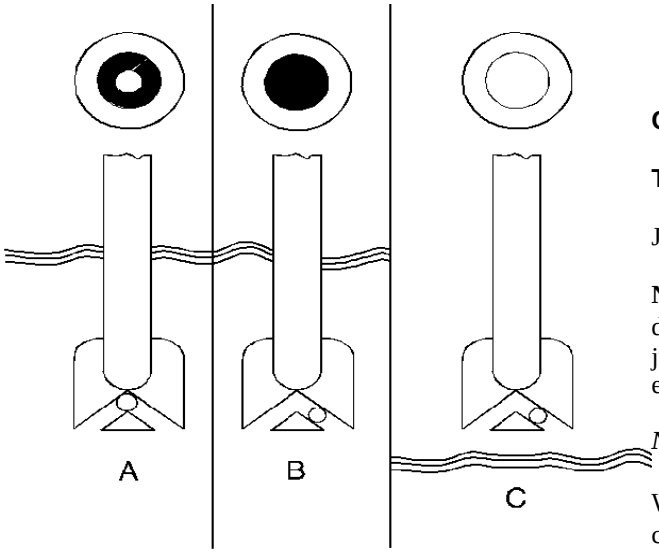
Step	Action	Value(s)	Yes	No
	2. Attempt to rotate the negative battery cable connector clockwise with light finger pressure. Does the negative connector rotate?			**7**
6	Use a torque wrench in order to verify the torque to loosen the negative battery terminal bolt. Is the torque above the specified value?	10 Nm (88 lb in)	Go to **Step 8**	Go to **Step 7**
7	***Caution: Refer to "Battery Disconnect Caution" in Cautions and Notices.*** Disconnect the negative battery cable. Is the cable disconnected?	—	Go to **Step 9**	—
8	***Caution: Refer to "Battery Disconnect Caution" in Cautions and Notices.*** Ensure the negative battery cable is disconnected. Inspect for the following conditions and repair as needed: • The cable bolt is too long or deformed at the end. • There is foreign material present inside the nut in the battery terminal. • Damage to the battery terminal face or cable connector ring. Is the repair complete?	—	Go to **Step 9**	—
9	Rotate the positive battery cable connector clockwise with light finger pressure. Does the positive connector rotate?	—	Go to **Step 10**	Go to **Step 11**
10	Use a torque wrench in order to verify the torque to loosen the positive battery terminal bolt. Is the torque above the specified value?	5 Nm (44 lb in)	Go to **Step 12**	Go to **Step 11**
11	***Caution: Refer to "Battery Disconnect Caution" in Cautions and Notices.*** Disconnect the positive battery cable. Is the cable disconnected?	—	Go to **Step 13**	—
12	***Caution: Refer to "Battery Disconnect Caution" in Cautions and Notices.*** 1. Ensure the positive battery cable is disconnected. 2. Inspect for the following conditions and repair as needed: • The cable bolt is too long or deformed at the end. • There is foreign material present inside the nut in the battery terminal. • Damage to the battery terminal face or cable connector ring. Is the repair complete?	—	Go to **Step 13**	—
13	1. Clean and wire brush the lead face of both battery terminals and the metal contact rings in both cable connectors. 2. Remove the bolts from the cable connectors in order to provide access to the connector rings as needed. 3. If either the battery terminals or the cable rings are excessively damaged or corroded, replace as needed. Are the metal connecting parts clean and in good condition?	—	Go to **Step 14**	—
14	1. Connect the positive battery cable to the battery positive terminal. 2. Tighten the cable bolt to the specified value. Refer to **"Fastener Tightening Specifications"** . Is the cable bolt properly tightened?	10 Nm (88 lb in)	Go to **Step 15**	—
15	1. Connect the negative battery cable to the battery negative terminal. 2. Tighten the cable bolt to the specified value. Refer to **"Fastener Tightening Specifications"** in this section. Is the cable bolt properly tightened?	5 Nm (44 lb in)	Go to **Step 16**	—

Step	Action	Value(s)	Yes	No
16	**Important:** Make sure all electrical loads are turned OFF. 1. Install the J 42000 Battery Tester. 2. Follow the directions supplied with the tester. 3. Follow any direction displayed on the tester. Did the tester pass the battery?	—	Go to **Step 17**	Go to **Step 18**
17	1. Press the CODE button on the J 42000 . 2. For warranty purposes, write the displayed code on the repair order. Did you complete this action?	—	Battery OK	—
18	1. Press the CODE button on the J 42000 . 2. For warranty purposes, write the displayed code on the repair order. Replace the battery. Refer to **"Battery Replacement"** . Did you complete the replacement?	—	Battery OK	—
19	Replace the battery. Refer to **"Battery Replacement"** . Did you complete the replacement?	—	Battery OK	—

Diagnostic Information and Procedures

Battery Charging

- For best results, use an automatic, taper-rate battery charger with a voltage capability of 16 volts.
-



A battery showing a green dot in the hydrometer (A), does not need to be charged unless the J 42000 digital battery tester has shown that the battery needs to be charged.

- A battery showing a dark dot in the hydrometer (B) should be charged unless the J 42000 digital battery tester has indicated no charge is needed.
- Do not charge a battery when the built in hydrometer is clear or yellow in the center (C). Tap the hydrometer lightly in order to dislodge any air bubbles. The bubbles may cause a false indication. If the hydrometer is still clear or yellow, replace the battery.
- The charging area should be well ventilated.
- Do not charge a battery that appears to be frozen; allow the battery to warm to room temperature and test it before charging.

Charging Time Required

The time required to charge a battery will vary depending upon the following factors:

1. The battery charger capacity. The higher the charger's amperage, the less time it will take to charge the battery.
2. The state-of-charge of the battery. A completely discharged battery requires more than twice as much charging time as a half charged battery. In a discharged battery with a voltage below 11 volts, the battery has a very high internal resistance and may only accept a very low current at first. Later, as the charging current causes the acid content to increase in the electrolyte, the charging current will increase. Extremely discharged batteries may not activate the reversed voltage protection in some chargers. Refer to the manufacturers instructions for operating this circuitry.
3. The temperature of the battery. The colder the battery is, the more time it takes to recharge the battery. The charging current accepted by a cold battery is very low at first, then, as the battery warms, the charging current will increase.

Charging Procedure

Tools Required

JBGM P/N 12303040 Battery Charger

Notice: Turn OFF the ignition when connecting or disconnecting the battery cables, the battery charger or the jumper cables. Failure to do so may damage the PCM or other electronic components.

Notice: Refer to Fastener Notice in Cautions and Notices.

When charging batteries with the battery cables connected, connect the charger to the positive cable bolt and to a ground located away from the battery.

Tighten: Tighten the battery terminal to 5 Nm (44 lb in).

Use the following procedure to charge the battery:

1. Turn OFF the charger.
2. Ensure all battery terminal connections are clean and tight.
3. Connect the charger positive lead to the battery positive terminal.

   Important:: Do not connect the negative charger lead to the housings of other vehicle electrical accessories or equipment. The action of the battery charger may damage such equipment.
4. Connect the negative charger lead to a solid engine ground or to a ground stud in the engine compartment that is connected directly to the battery negative terminal, but away from the battery. If the negative battery cable is disconnected and a terminal adapter is being used, connect directly to the adapter.
5. Turn ON the charger and set to the highest setting for normal charging.
6. Inspect the battery every half hour after starting the battery charger.
   - Charge the battery until the hydrometer has a green dot or until the taper-rate charger indicates the battery is fully charged, whichever occurs first.
   - Tap the hydrometer lightly in order to dislodge any air bubbles. The bubbles may cause a false indication.
   - Estimate the battery temperature by feeling the side of the battery. If it feels hot to the touch or its temperature is over 45°C (125° F), discontinue charging and allow the battery to cool before resuming charging.
7. After charging, test the battery. Refer to **"Battery Inspection/Test"** .

Diagnostic Information and Procedures

Battery Electrical Drain/Parasitic Load Test

Battery Electrical Drain

If the vehicle exhibits a low or dead battery after an overnight period, or discharges over a period of 2 or 3 days, the electrical system should be checked for an excessive electrical drain. This is referred to as Parasitic Current Drain.

If a battery needs recharging and no cause is evident, check the vehicle for excessive parasitic current drain.

One or more on-board solid state control modules, such as the ECM/PCM may at some time exhibit a failure mode that causes a high parasitic drain on the vehicle's battery. When the battery is disconnected to install an ammeter, etc., the excessive current drain may not occur once the circuit continuity is restored. Even though cycling the ignition key to the RUN and then to the OFF position may cause such a drain to recur, there may be drains that will not recur unless the vehicle systems are reactivated in a road test. Since the ignition switch must not be rotated to the ACCESSORY, RUN or START position with an ammeter installed between the battery terminal and the battery cable, a current drain test tool must be used as described in the following procedures.

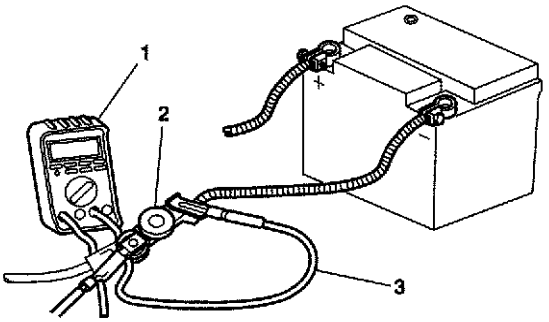
Before starting this procedure, ensure that the ignition switch is in the LOCK position, all electrical accessories are turned OFF, the door glass is open and the doors are closed.

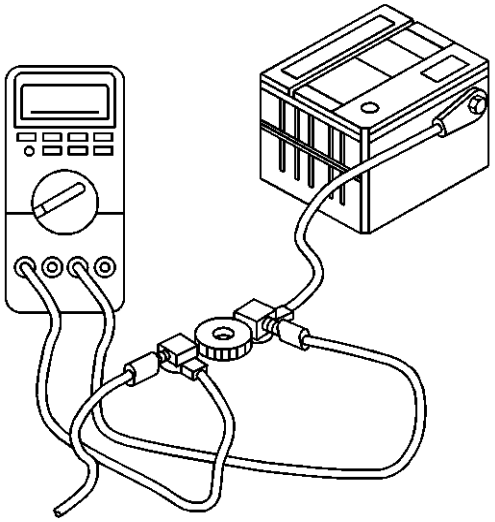
Caution: Before servicing any electrical component, the ignition key must be in the OFF or LOCK position and all electrical loads must be OFF, unless instructed otherwise in these procedures. If a tool or equipment could easily come in contact with a live exposed electrical terminal, also disconnect the negative battery cable. Failure to follow these precautions may cause personal injury and/or damage to the vehicle or its components.

Notice: Do not turn the parasitic draw test switch to the OFF position with the engine running. Damage will occur to the vehicle's electrical system.

Notice: The test switch must be in the ON position when removing the fuses in order to maintain continuity in the electrical system. This avoids damaging the digital multimeter due to accidental overloading, such as a door being opened to change a fuse.

1. Disconnect the battery negative cable. Refer to **"Battery Negative Cable Disconnect/Connect Procedure"** .
2.





Install the male end of the J 38758 (2) to the battery negative terminal.

3. Turn OFF the test switch.
4. Install the battery negative cable to the female end of the test switch.
5. Turn ON the test switch.
6. Road test the vehicle while activating all accessories, including the radio and the air conditioning.
7. Turn OFF the ignition switch. Remove the key.
8. **Important:** From this point on, electrical continuity must be maintained in the ground circuit of the battery through the J 38758 (2) in the ON position or through the J 39200 (1) .

   Components such as PCM have timers that draw several amps of current while they cycle down. This can give a false parasitic drain reading. Wait 15 minutes for these components to power down before continuing this test.
9. Set the J 39200 (1) to the 10 A scale.

   Important: If an ammeter other than the J 39200 (1) is used, ensure that the vehicle does not have a high current drain that would damage the ammeter when connected to the circuit. This can be done using the following procedure:

   1. Connect a jumper wire with an in-line 10 A fuse J 36169-A (3) to the terminals of the test switch.
   2. Turn the test switch to the OFF position.
   3. Wait ten seconds.
   4. If the fuse does not blow, the current is less than 10 A and the ammeter can be used safely.
   5. Turn the test switch to the ON position before the fused jumper wire is remove and the multimeter is installed.
10. Connect the ammeter to the test switch terminals.
11. Turn OFF the test switch. This allows the current to flow through the ammeter.
12. Wait at least 60 seconds, then check the current reading.

    - When there is a current reading of 2 A or less, turn ON the test switch, this maintains continuity in the electrical system.
    - Then, switch the meter down to the 2 A scale, for a more accurate reading, when the test switch is reopened.
13. Take the reading in milli-amps.
14. Note the battery reserve capacity. Refer to **"Battery Usage"** .

    - Divide this number by 4.
    - Compare this to the multimeter reading.
    - The current drain should not exceed this number.
    - Example: if a battery has a reserve capacity of 100 minutes, the current drain should not exceed 25 milli-amps.
15. **Notice:** Always turn the test switch knob to the ON position before removing each fuse to maintain continuity in the electrical system and to avoid damaging the meter due to accidental overloading, such as opening a door to change a fuse.

    When the current draw is too high, remove the electrical system fuses one at a time until the draw returns to a value less than or equal to specifications.
16. Repeat the parasitic current drain test procedure after any repair has been completed.
17. When the cause of the excessive current draw has been located and repaired, remove the meter and the parasitic draw test switch and terminal adapters.
18. Connect the negative cable to the battery negative terminal. Refer to **"Battery Negative Cable Disconnect/Connect Procedure"** .

Diagnostic Information and Procedures

Battery Common Causes of Failure

A battery is not designed to last forever. With proper care, however, the battery will provide years of good service. If the battery tests good but still fails to perform well, the following are some of the more common causes:

1. A vehicle accessory was left on overnight.
2. The driving speeds have been slow with frequent stops (stop-and-go driving) with many electrical accessories in use, particularly air conditioning, headlights, wipers, heated rear window, cellular telephone, etc.
3. The electrical load has exceeded the generator output (particularly with the addition of aftermarket equipment).
4. Existing conditions in the charging system, including the following possibilities.
    - A slipping belt
    - A bad generator
5. The battery has not been properly maintained, including a loose battery hold down or missing battery insulator if used.
6. There are mechanical conditions in the electrical system, such as a short or a pinched wire, attributing to power failure. Refer to **"General Electrical Diagnosis Procedures"** in Wiring Systems.

Electrolyte Freezing

The freezing point of electrolyte depends on its specific gravity. A fully charged battery will not freeze until the ambient temperature gets below -54° C (-65°F). However, a battery with a low state of charge may freeze at temperatures as high as -7°C (20° F). Since freezing may ruin a battery, the battery should be protected against freezing by keeping it properly charged. As long as the green eye is visible in the hydrometer, the freezing point of the battery will be somewhere below -32°C (-25° F).

Battery Protection During Vehicle Storage

Certain devices on the vehicle maintain a small continuous current drain (parasitic load) on the battery. A battery that is not used for an extended period of time will discharge. Eventually permanent damage will result. Discharged batteries will also freeze in cold weather. Refer to **"Battery Inspection/Test"** .

In order to maintain a battery state of charge while storing the vehicle for more than 30 days:

1. **Important:** If a green dot is not visible in the hydrometer, test the battery. Refer to **"Battery Inspection/Test"** .

   Make sure the that the green dot is visible in the built-in hydrometer.

2. ***Caution: Refer to Battery Disconnect Caution in Cautions and Notices.***

   Disconnect the battery (negative) ground to protect the battery from discharge by parasitic current drains.

When the battery cannot be disconnected:

1. Maintain a high state of charge.
2. Establish a regular schedule for recharging the battery every 20–45 days.

A battery that has remained in a discharged state for a long period of time is difficult to recharge or may be permanently damaged.

Diagnostic Information and Procedures

Jump Starting in Case of Emergency

Caution: Batteries produce explosive gases. Batteries contain corrosive acid. Batteries supply levels of electrical current high enough to cause burns. Therefore, in order to reduce the risk of personal injury while working near a battery, observe the following guidelines:

- Always shield your eyes.
- Avoid leaning over the battery whenever possible.
- Do not expose the battery to open flames or sparks.
- Do not allow battery acid to contact the eyes or the skin.
    - Flush any contacted areas with water immediately and thoroughly.
    - Get medical help.

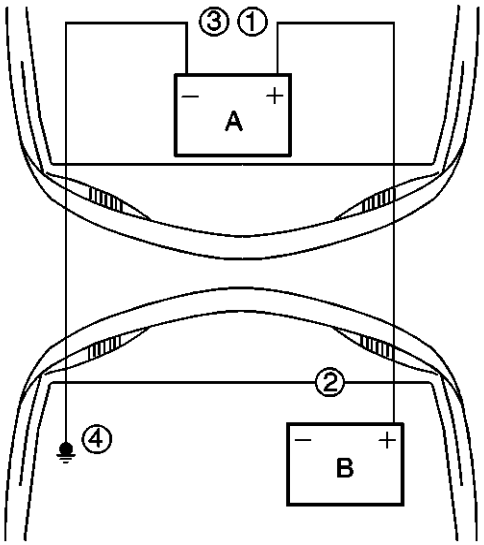
Notice: This vehicle has a 12 volt, negative ground electrical system. Make sure the vehicle or equipment being used to jump start the engine is also 12 volt, negative ground. Use of any other type of system will damage the vehicle's electrical components.

This vehicle has a 12 volt positive, negative ground electrical system. Do not try to jump start a vehicle if you are unsure of the other vehicle's positive voltage or ground position. The booster (charged) battery and the discharged battery should be treated carefully when using jumper cables.

1. Position the vehicle with the booster (charged) battery so that the jumper cables will comfortably reach the battery of the other vehicle.
    - Do not let the two vehicles touch.
    - Make sure that the jumper cables do not have loose clamps or missing insulation.
2. Perform the following steps on both vehicles:
    1. Place the automatic transmission in PARK.

2. Block the wheels.
3. Set the parking brake.
4. Turn off all electrical loads that are not needed (leave the hazard flashers ON).
5. Turn OFF the ignition switch.

2.



Important: Some vehicles have a battery remote positive stud. ALWAYS use the battery remote positive stud in order to give or to receive a jump start.

Attach the end of one jumper cable to the positive terminal of the discharged battery.

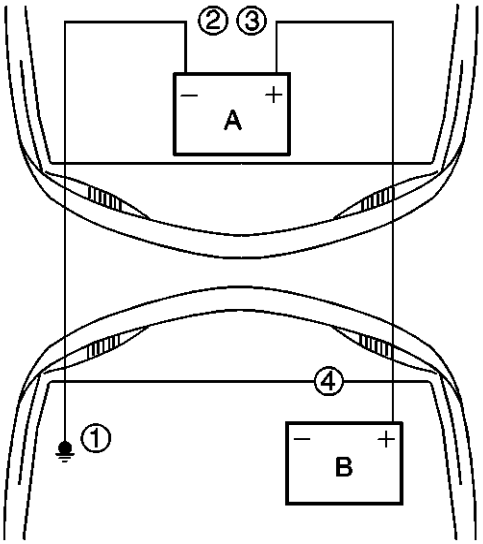
3. Attach one end of the remaining jumper cable to the negative terminal of the booster battery.
4. ***Notice:*** Do not connect the negative booster cable to the housings of other vehicle electrical accessories or equipment. The current flow during jump starting may damage such equipment.

   Make the final connection of the negative jumper cable to the block or suitable bracket connected directly to the block, away from the battery.
5. Start the engine of the vehicle that is providing the jump start and turn off all electrical accessories. Raise the engine RPM to approximately 1500 RPM.
6. Crank the engine of the vehicle with the battery.

   If the engine does not crank or cranks too slowly, perform the following steps:

   1. Turn the ignition OFF.
   2. Allow the booster vehicle engine to run at approximately 1500 RPM for five minutes.
   3. Attempt to start the engine of the vehicle with the discharged battery.

7.



Reverse the steps exactly when removing the jumper cables. The negative battery cable must first be disconnected from the engine that was jump started .

Diagnostic Information and Procedures

Starter Motor Noise Diagnosis

Diagnostic Aids

Inspect the flywheel ring gear for damage or unusual wear.

Shim the starter as required.

In order to add pinion to ring gear clearance a full size shim must be used. Do not shim only one starter mounting bolt. There are three shims available in different shapes (for clearance) — all are 1 mm thick.

Step	Action	Yes	No
1	Did you perform the Engine Electrical Diagnostic System Check?	Go to **Step 2**	Go to **"Diagnostic System Check - Engine Electrical"**
2	Start the engine. Does the starter operate normally?	Go to **"Testing for Intermittent and Poor Connections"** in Wiring Systems	Go to **Step 3**
3	Start the engine while listening to the starter motor turn. Is there a loud "whoop" (it may sound like a siren if the engine is revved while the starter is engaged) after the engine starts, but while the starter is still held in the engaged position?	Go to **Step 6**	Go to **Step 4**

Step	Action	Yes	No
4	Do you hear a "rumble", a "growl", or, in some cases, a "knock" as the starter is coasting down to a stop after starting the engine?	Go to **Step 7**	Go to **Step 5**
5	When the engine is cranked, do you hear a high-pitched whine after the engine cranks and starts normally? (This is often diagnosed as a starter drive gear hang-in or a weak solenoid.)	Go to **Step 8**	Go to **Step 7**
6	Inspect the flywheel ring gear for the following: • Chipped gear teeth • Missing gear teeth • Milled teeth Is the flywheel bent, or does it have damaged teeth?	Go to **Step 9**	Go to **Step 10**
7	1. Remove the starter motor. Refer to **"Starter Motor Replacement (2.4L)" "Starter Motor Replacement (4.3L)"** . 2. Inspect the starter motor bushings and clutch gear. Does the clutch gear have chipped or milled teeth or worn bushings?	Go to **Step 10**	Go to **Step 9**
8	Shim the starter motor away from the flywheel by adding shims between the starter motor and the engine block one at a time. Flywheel runout may make this noise appear to be intermittent. Did you complete the repair?	Go to **Step 11**	—
9	Replace the flywheel. Refer to **"Engine Flywheel Replacement"** in Engine Mechanical 2.4L, or **"Engine Flywheel Replacement"** in Engine Mechanical 4.3L. Did you complete the replacement?	Go to **Step 11**	—
10	Replace the starter motor. Refer to **"Starter Motor Replacement (2.4L)" "Starter Motor Replacement (4.3L)"** . Did you complete the replacement?	Go to **Step 11**	—
11	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 3**

Diagnostic Information and Procedures

Charging System Test

Test Description

The number below refers to the step number on the diagnostic table.

10. If the test has shown the generator to be OK, however the condition remains, test the PCM or its control circuit(s) to the generator.

Step	Action	Value(s)	Yes	No
1	Did you perform the Engine Electrical Diagnostic System Check?	—	Go to **Step 2**	Go to **"Diagnostic System Check - Engine Electrical"**
2	Start the engine, observe the charge indicator on the instrument cluster (IPC) . Does the charge indicator illuminate?	—	Go to **Step 3**	Go to **"Symptoms - Engine Electrical"**
3	**Important:** The green POWER lamp of the tester should remain illuminated while the tester is being used. 1. Turn OFF the ignition. Connect the red lead of the J 41450-B Generator Electronic Tester to the generator output terminal. 2. Connect the black lead of the J 41450-B to the	—	Go to **Step 6**	Go to **Step 4**

Step	Action	Value(s)	Yes	No
	metal generator housing. Does the green POWER lamp on the tester illuminate?			
4	Measure the voltage from the output terminal of the generator to the generator metal housing. Does the voltage measure equal to the specified value?	12.0 V	Go to **Step 14**	Go to **Step 5**
5	Measure the voltage from the output terminal of the generator to the battery negative terminal. Does the voltage measure equal to the specified value?	12.0 V	Go to **Step 12**	Go to **Step 11**
6	Turn OFF completely the load tool before connecting or disconnecting a carbon pile load tester to the battery. Otherwise, sparking at the terminals could cause battery gasses to explode and cause personal injury. 1. Connect a carbon pile tester to the vehicle **Important:** Ensure that all generator output circuit wires pass through the inductive probe. 2. Connect an inductive ammeter to the output circuit of the generator. 3. Disconnect the generator harness connector. 4. Locate the matching harness connector on the J 41450-B , and connect the connector to the generator. Does the red DIAGNOSTIC lamp on the tester illuminate?	—	Go to **Step 7**	Go to **Step 13**
7	1. Start the engine and allow it to idle for 30 seconds. 2. Increase the engine speed to 2,500 RPM. Does the red DIAGNOSTIC lamp on the tester illuminate?	—	Go to **Step 15**	Go to **Step 8**
8	1. Maintain the engine speed at 2,500 RPM. **Important:** If the generator is not capable of producing the Load Test amps, operate the generator at it's maximum possible output. 2. Turn ON the load of the carbon pile tester and increase the load until the generator output is equal to the Load Test value given in Generator Usage. Does the red DIAGNOSTIC lamp on the tester illuminate?	—	Go to **Step 15**	Go to **Step 9**
9	1. Maintain the engine speed at 2,500 RPM and continue to operate the generator at the load test value. 2. Measure the voltage drop from the output terminal of the generator to the positive terminal on the battery. Refer to **"Circuit Testing"** and **"Connector Repairs"** in Wiring Systems. Does the voltage measure greater than the specified value?	0.5 V	Go to **Step 11**	Go to **Step 10**
10	1. Maintain the engine speed at	0.5 V	Go to **Step 12**	Go to **Step 16**

Step	Action	Value(s)	Yes	No
	2,500 RPM and continue to operate the generator at the load test value. 2. Measure the voltage drop from the battery negative terminal to the metal housing of the generator. Refer to **"Circuit Testing"** and **"Connector Repairs"** in Wiring Systems. Does the voltage measure greater than the specified value?			
11	Repair the high resistance or an open in the output circuit of the generator. Refer to Circuit Testing and Connector Repairs in Wiring Systems. Refer to **"Circuit Testing"** and **"Connector Repairs"** in Wiring Systems. Did you complete the repair?	—	Go to **Step 16**	—
12	Repair the high resistance or open in the ground circuit of the generator. Refer to Circuit testing and Connector Repairs in Wiring Systems. Refer to **"Circuit Testing"** and **"Connector Repairs"** in Wiring Systems. Did you complete the repair?	—	Go to **Step 16**	—
13	1. Disconnect the J 41450-B Tester Harness Connector from the generator, but leave the alligator clips connected so that the green POWER lamp remains illuminated. 2. Connect a jumper lead, with an in-line 100-ohm resistor between the J 41450-B Tester Harness Connector terminal B and a good ground. Refer to Engine Electrical Connector End Views . Does the red DIAGNOSTIC lamp illuminate?	—	Go to **Step 15**	Go to **Step 14**
14	There is a problem with the J 41450-B . Refer to the manufacturers instructions, how to test the J 41450-B for proper operation. Has the J 41450-B tester been replaced?	—	Go to **Step 3**	—
15	Replace the generator. Refer to **"Generator Replacement (2.4L)" "Generator Replacement (4.3L)"** . Did you complete the replacement?	—	Go to **Step 16**	—
16	Operate the vehicle in order to verify the repair. Did you correct the condition?	—	System OK	Go to **Step 2**

Diagnostic Information and Procedures

Generator Noise Diagnosis

Diagnostic Aids

Noise from a generator may be due to electrical or mechanical noise. Electrical noise (magnetic whine) usually varies with the electrical load placed on the generator and is a normal operating characteristic of all generators. When diagnosing a noisy generator, it is important to remember that loose or misaligned components around the generator may transmit the noise into the passenger compartment and that replacing the generator may not solve the problem.

Step	Action	Yes	No
1	Test the generator for proper operation using the Generator Tester. Refer to **"Charging System Test"** . Is the generator operating properly?	Go to **Step 2**	Go to **Step 11**
2	1. Start the engine. Verify that the noise can be heard. 2. Turn OFF the engine. 3. Disconnect the connectors from the generator. 4. Start the engine. 5. Listen for the noise.	Go to **Step 11**	Go to **Step 3**

Step	Action	Yes	No
	Has the noise stopped?		
3	1. Turn OFF the engine. 2. Remove the drive belt. Refer to **"Drive Belt Replacement"** in Engine Mechanical – 2.4L, or **"Drive Belt Replacement"** in Engine Mechanical – 4.3L. 3. Spin the generator pulley by hand. Does the generator shaft spin smoothly and without any roughness or grinding noise?	Go to **Step 4**	Go to **Step 11**
4	Inspect the generator for a loose pulley and/or pulley nut. Is the generator pulley or pulley nut loose?	Go to **Step 11**	Go to **Step 5**
5	1. Loosen all of the generator mounting bolts. 2. Tighten the generator mounting bolts to specifications and in the proper sequence (if necessary). Refer to **"Generator Replacement (2.4L)" "Generator Replacement (4.3L)"** . 3. Install the drive belt. Refer to **"Drive Belt Replacement"** in Engine Mechanical – 2.4L, or **"Drive Belt Replacement"** in Engine Mechanical – 4.3L. 4. Start the engine. Has the noise decreased or stopped?	System OK	Go to **Step 6**
6	Inspect the generator for the following conditions: • Strained or stretched electrical connections. • Hoses or other vehicle equipment resting on the generator (which may cause the noise to be transmitted into the passenger compartment) Are any electrical connections pulling on the generator or are any hoses, etc. resting on the generator?	Go to **Step 7**	Go to **Step 8**
7	1. Reroute the electrical connections to relieve the tension. 2. Reroute the hoses, etc. away from the generator. 3. Start the engine. Has the noise decreased or stopped?	System OK	Go to **Step 8**
8	Inspect the drive belt for proper tension. Refer to **"Drive Belt Tensioner Diagnosis"** in Engine Mechanical – 2.4L, or **"Drive Belt Tensioner Diagnosis"** in Engine Mechanical – 4.3L.	Go to **Step 9**	Go to **Step 10**
	Is the drive belt loose?		
9	1. Replace the drive belt tensioner. Refer to **"Drive Belt Tensioner Replacement"** in Engine Mechanical – 2.4L, or **"Drive Belt Tensioner Replacement"** in Engine Mechanical – 4.3L. 2. Start the engine. Has the noise decreased or stopped?	System OK	Go to **Step 11**
10	Compare the vehicle with a known good vehicle. Do both vehicles make the same noise?	System OK	Go to **Step 11**
11	**Important:** If no definite generator problems were found, be sure that all other possible sources of objectionable noise are eliminated before replacing the generator. Replacing the generator may not change the noise level if the noise is a normal characteristic of the generator or the generator mounting. Replace the generator. Refer to **"Generator Replacement (2.4L)" "Generator Replacement (4.3L)"** . Has the noise decreased or stopped?	Go to **Step 12**	—
12	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 2**

Repair Instructions

Battery Negative Cable Disconnect/Connect Procedure

Disconnecting the Negative Battery Cable for Service

Caution: Refer to Battery Disconnect Caution in Cautions and Notices.

1. Record all preset codes from the radio.
2. Turn the ignition switch to the LOCK position.
3. Verify that all the electrical components are off such as interior lights, all doors are closed, the underhood lamp etc.
4. Remove the retaining bolt from the battery negative cable.
5. Remove the battery negative cable from the battery.
6. Position the battery negative cable away from any body ground.

Connecting the Negative Battery Cable for Service

1. Verify that all electrical components are off such as interior lights, all doors are closed, the underhood lamp etc.
2. Clean corrosion from the battery negative cable using a metal brush.
3. Install the battery negative cable to the battery.
4. ***Notice:*** Refer to Fastener Notice in Cautions and Notices.

   Install the retaining bolt to the battery negative cable.

   Tighten: Tighten the battery negative cable to 5 Nm (44 lb in).
5. Reset the radio stations and the clock.

Repair Instructions

Battery Negative Cable Replacement (2.4L)

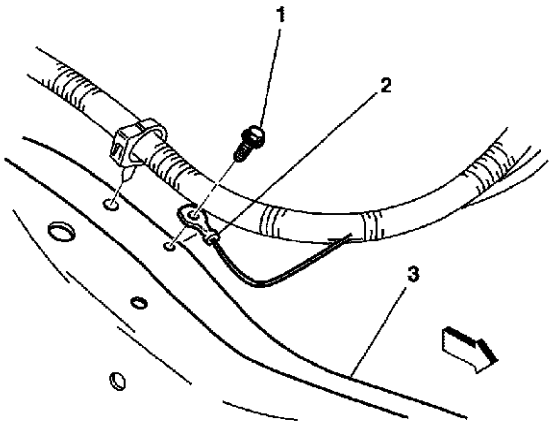
Removal Procedure

- ***Caution: Refer to Vehicle Lifting Caution in Cautions and Notices.***

  Caution: Refer to Battery Disconnect Caution in Cautions and Notices.

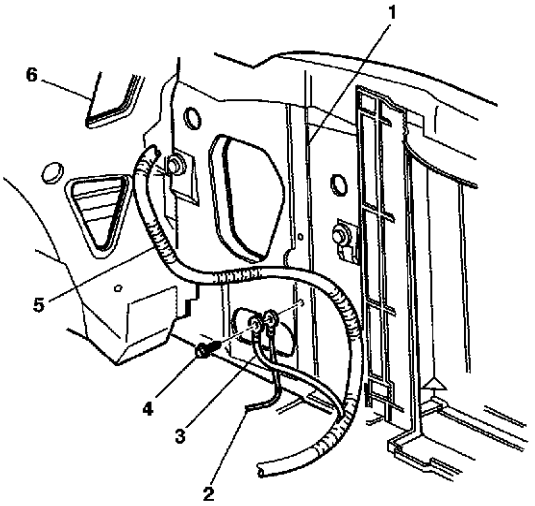
  Note: Top post battery shown, side post battery is similar.

  Disconnect the negative battery cable. Refer to **"Battery Negative Cable Disconnect/Connect Procedure"** .
- Raise and support the vehicle with safety stands. Refer to **"Lifting and Jacking the Vehicle"** in General Information.
-



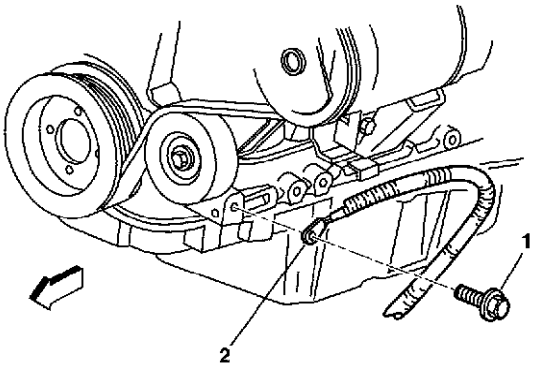
Remove the bolt (1) anchoring the negative battery cable (2) to the frame (3).

-

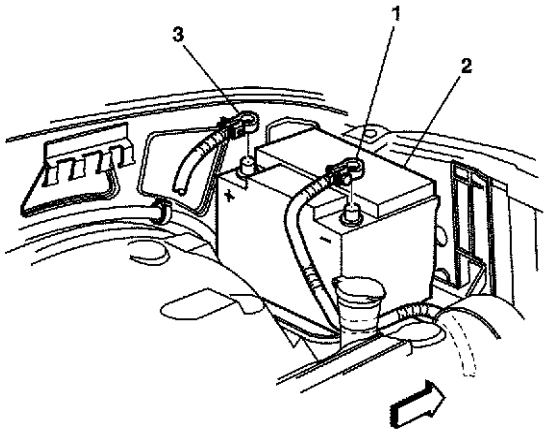


Remove the bolt (4) anchoring the negative battery cable (3) to the radiator support (1).

-

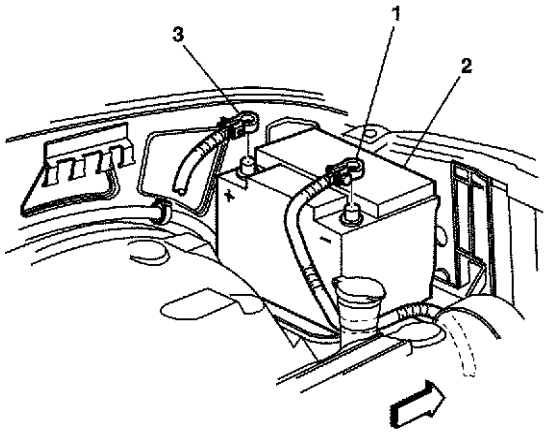


Remove the bolt (1) securing the negative cable (2) to the engine.

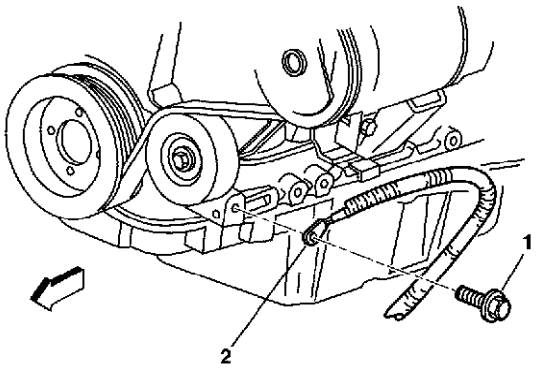
- 

Remove the negative battery cable (1).

Installation Procedure

- 

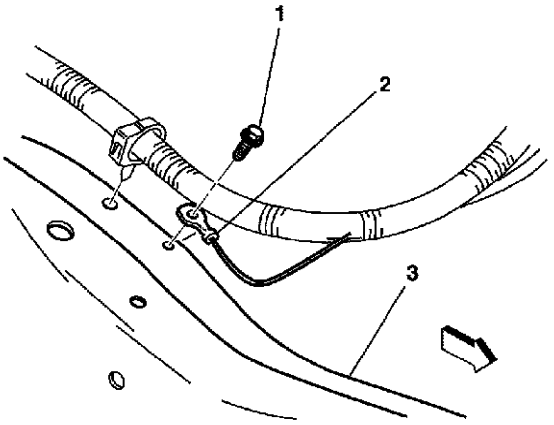
Install the negative battery cable (1).

- 

Notice: Refer to Fastener Notice in Cautions and Notices.

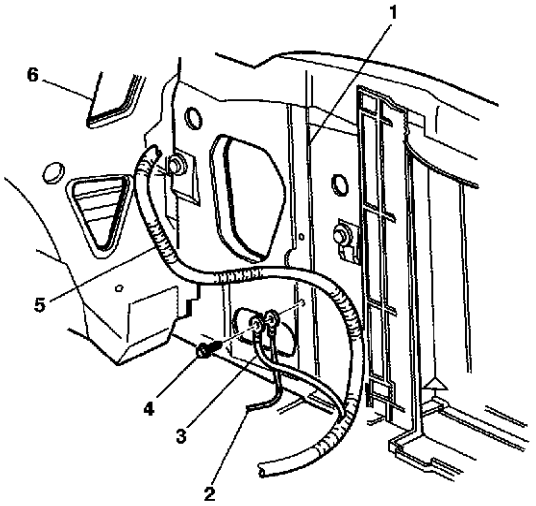
Install the bolt (1) anchoring the negative battery cable (2) to the engine.

Tighten: Tighten the bolt to 41 Nm (30 lb ft).

- 

Install the bolt (1) anchoring the negative battery cable (2) to the frame (3).

Tighten: Tighten the bolt to 6 Nm (53 lb in).

- 

  Install the bolt (4) anchoring the negative battery cable (3) to the radiator support (1).

  Tighten: Tighten the bolt to 6 Nm (53 lb in).

- Remove the safety stands.
- Lower the vehicle.
- Connect the negative battery cable. Refer to **"Battery Negative Cable Disconnect/Connect Procedure"** .

Repair Instructions

Battery Negative Cable Replacement (4.3L)

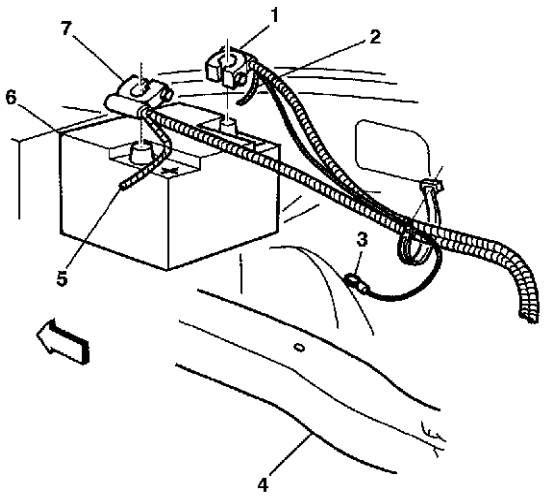
Removal Procedure

- ***Caution: Refer to Battery Disconnect Caution in Cautions and Notices.***

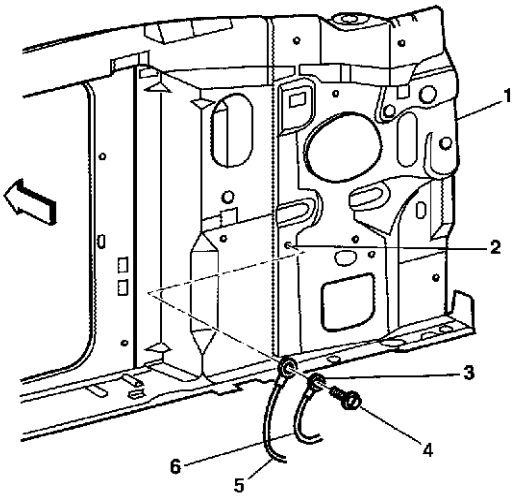
  Note: Top post battery shown, side post battery is similar.

  Disconnect the negative battery cable. Refer to **"Battery Negative Cable Disconnect/Connect Procedure"** .

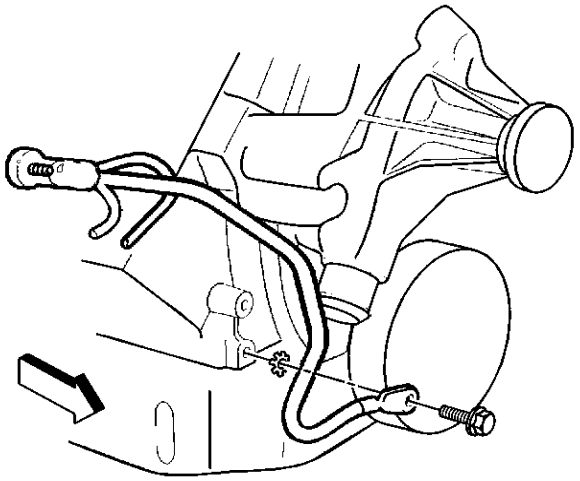
- Raise and support the vehicle. Refer to **"Lifting and Jacking the Vehicle"** in General Information.

- 

  Remove the bolt anchoring the negative battery cable to the frame (3).

- 

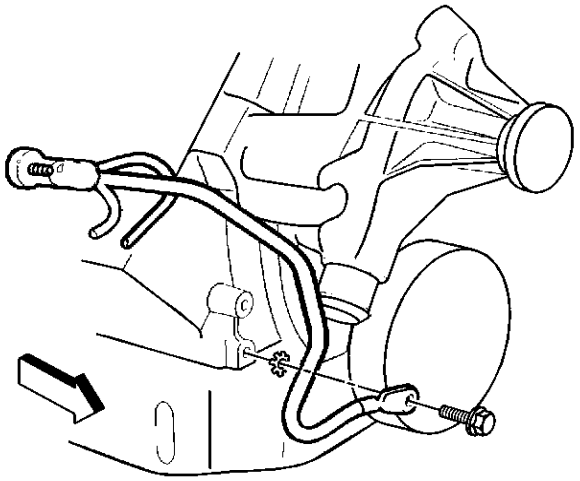
  Remove the bolt (4) anchoring the negative battery cable (6) to the radiator support (1).



Remove the bolt anchoring the negative battery cable to the block.

- Remove the negative battery cable.

Installation Procedure

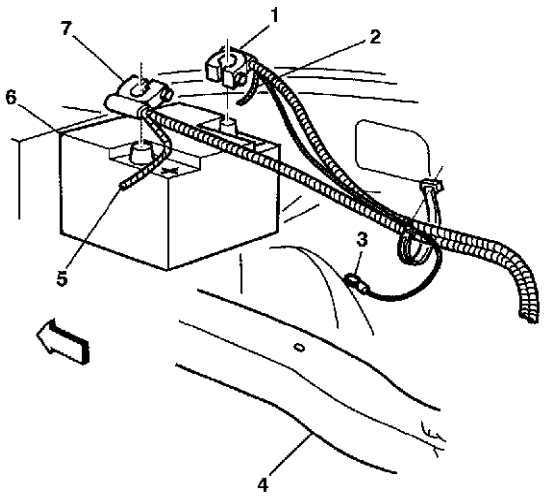


Install the negative battery cable.

- ***Notice:*** Refer to Fastener Notice in Cautions and Notices.

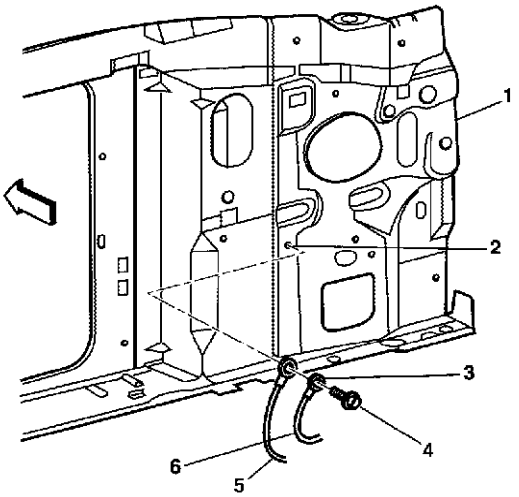
Install the bolt anchoring the negative battery cable to the block.

Tighten: Tighten the bolt to 17 Nm (13 lb ft).



Install the bolt anchoring the negative battery cable to the frame (3).

Tighten: Tighten the bolt to 6 Nm (53 lb in).



Install the bolt (4) anchoring the negative battery cable (6) to the radiator support (1).

Tighten: Tighten the bolt to 6 Nm (53 lb in).

- Remove the safety stands.
- Lower the vehicle.
- Connect the negative battery cable. Refer to **"Battery Negative Cable Disconnect/Connect Procedure"** .

Repair Instructions

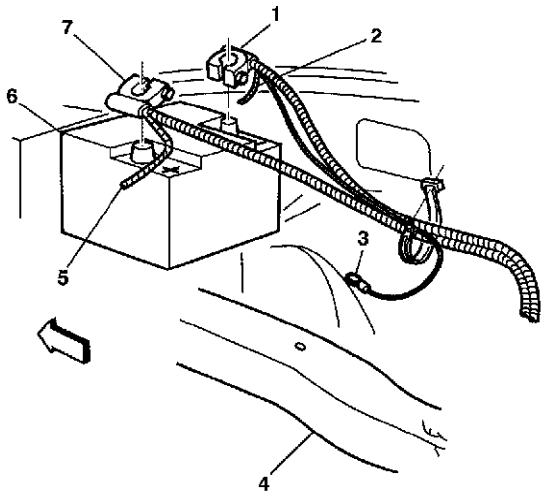
Battery Positive Cable Replacement (4.3L)

Removal Procedure

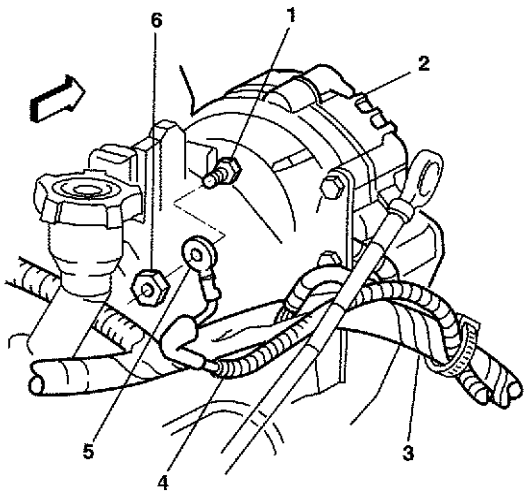
- ***Caution: Refer to Battery Disconnect Caution Battery Disconnect Caution in Cautions and Notices.***

  Note: Top post battery shown, side post battery is similar.

  Disconnect the negative battery cable (1). Refer to **"Battery Negative Cable Disconnect/Connect Procedure"** .

- 

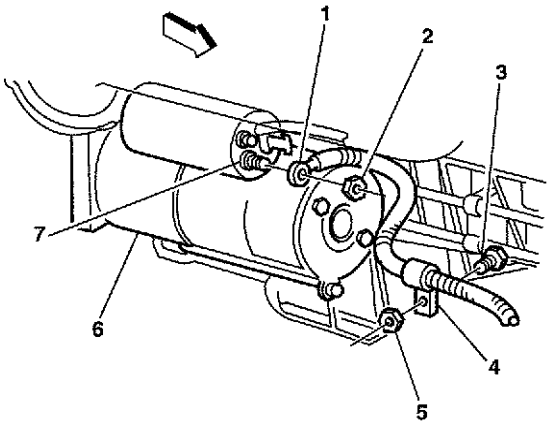
  Disconnect the battery positive cable (7) from the battery.

- 

  Remove the nut (6) retaining the battery positive cable (5) to the generator (2).

- ***Caution: Refer to Vehicle Lifting Caution in Cautions and Notices.***

  Raise and suitably support the vehicle with safety stands. Refer to **"Lifting and Jacking the Vehicle"** in General Information.

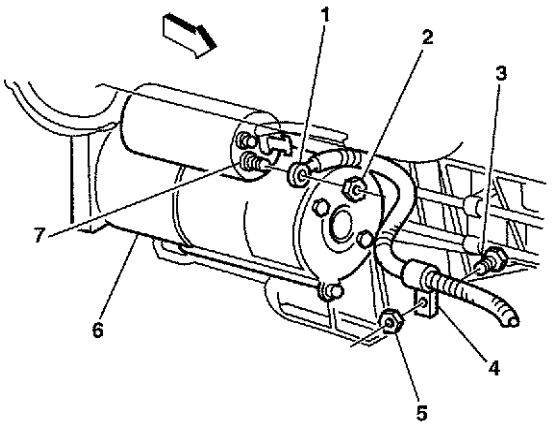
- 

  Remove the nut (2) retaining the battery positive cable (1) to the starter (6).

- Remove the nut (5) anchoring the battery positive cable (1) to the engine.

- Remove the battery positive cable.

Installation Procedure

- 

  Install the positive battery cable to the vehicle.

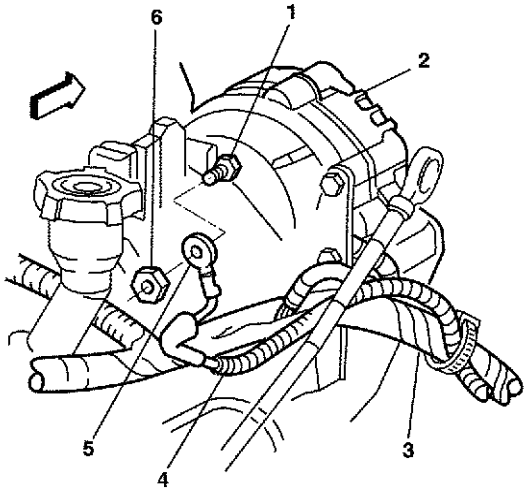
- ***Notice:*** Refer to Fastener Notice in Cautions and Notices.

  Install the nut (5) anchoring the positive battery cable to the engine.

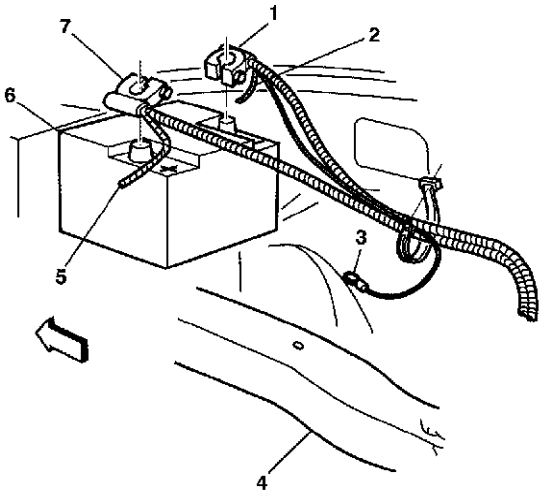
  Tighten: Tighten the nut to 6 Nm (53 lb in).

- Install the nut (2) retaining the battery positive cable (1) to the starter (6).

  Tighten: Tighten the nut to 10 Nm (88 lb in).

- Lower the vehicle.
- 

  Install the nut (6) retaining the battery positive cable (5) to the generator (2).

  Tighten: Tighten the nut to 17 Nm (12 lb ft).
- 

  Connect the battery positive cable (7) to the battery.
- Connect the battery negative cable (1) to the battery.

Repair Instructions

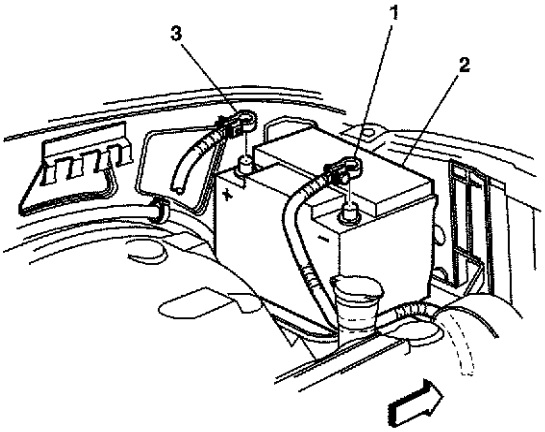
Battery Positive Cable Replacement (2.4L)

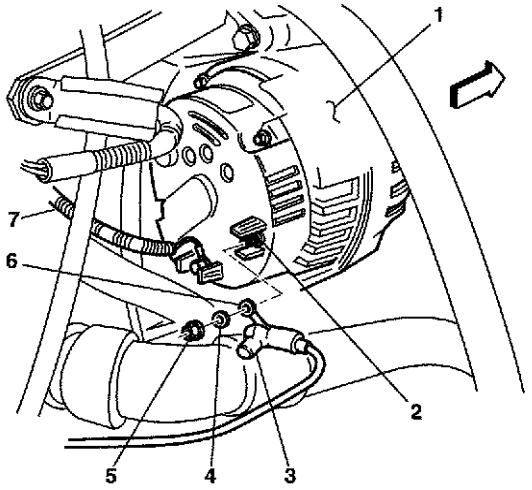
Removal Procedure

- ***Caution: Refer to Battery Disconnect Caution Battery Disconnect Caution in Cautions and Notices.***

  Note: Top post battery shown, side post battery is similar.

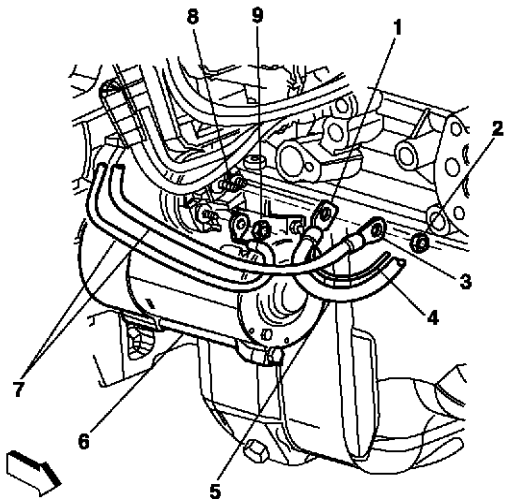
Disconnect the negative battery cable. Refer to **"Battery Negative Cable Disconnect/Connect Procedure"** .

- 

  Disconnect the battery positive cable (3) from the battery (1).
- 

  Remove the nut (5) retaining the battery positive cable (6) to the junction block.
- ***Caution: Refer to Vehicle Lifting Caution in Cautions and Notices.***

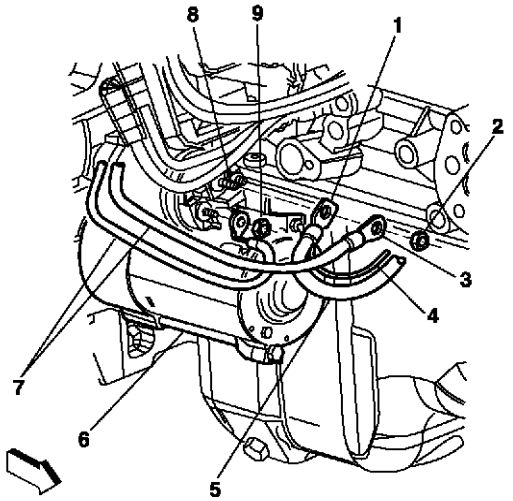
  Raise and suitably support the vehicle. Refer to **"Lifting and Jacking the Vehicle"** in General Information.

- 

  Remove the nut (2) retaining the battery positive cable (5) to the starter (6).

- Remove the battery positive cable.

Installation Procedure

- 

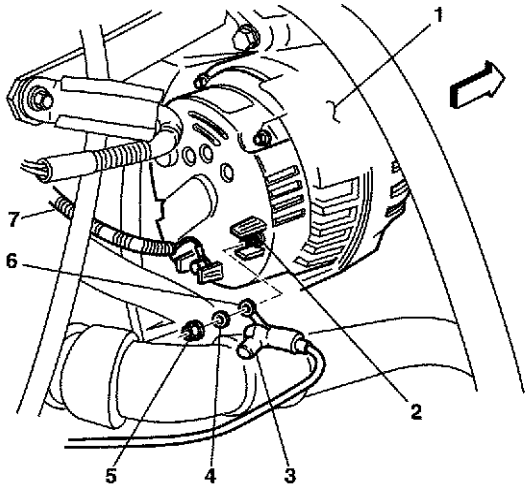
  Install the positive battery cable to the vehicle.

- Install the bolt anchoring the positive battery cable to the engine.
- ***Notice:*** Refer to Fastener Notice in Cautions and Notices.

  Install the nut (2) retaining the battery positive cable (5) to the starter (6).

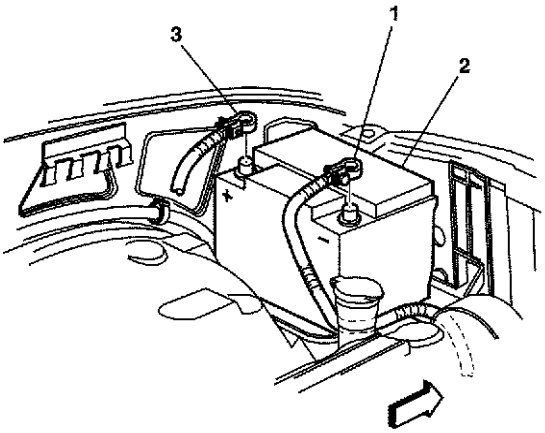
  Tighten: Tighten the nut to 10 Nm (88 lb in).

- Remove the safety stands and lower the vehicle.

- 

  Install the nut (5) retaining the battery positive cable (6) to the junction block.

  Tighten: Tighten the nut to 8 Nm (71 lb in).

- 

  Connect the battery positive cable (3) the battery.

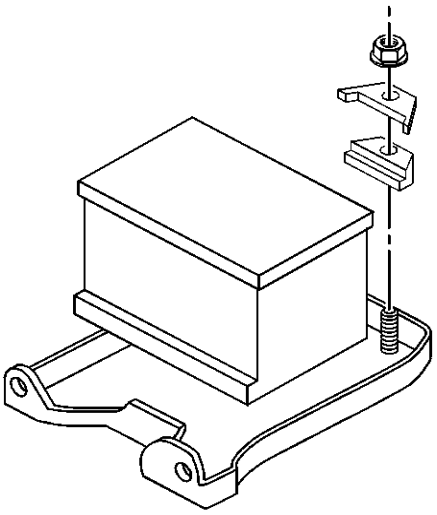
- Connect the battery negative cable (1) to the battery.

Repair Instructions

Battery Replacement

Removal Procedure

Caution: Refer to Batteries Produce Explosive Gases Caution in Cautions and Notices.

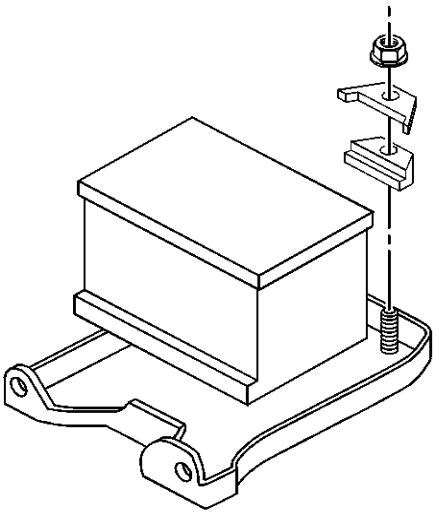
- 

Caution: Refer to Battery Disconnect Caution in Cautions and Notices.

Disconnect the battery negative cable. Refer to **"Battery Negative Cable Disconnect/Connect Procedure"** .

- Disconnect the battery positive cable.
- Remove the following parts:
  - The retainer nut
  - The retainer washer
  - The retainer
  - The battery
- Inspect the following items for physical damage or corrosion, clean as necessary:
  - The battery
  - The battery cables
  - The connectors
  - The battery tray

Installation Procedure

- 

Notice: Refer to Fastener Notice in Cautions and Notices.

Install the following parts:

- The battery onto a cleaned battery tray
- The retainer
- The retainer washer
- The retainer nut

  Tighten: Tighten the retainer nut to 17 Nm (13 lb ft).

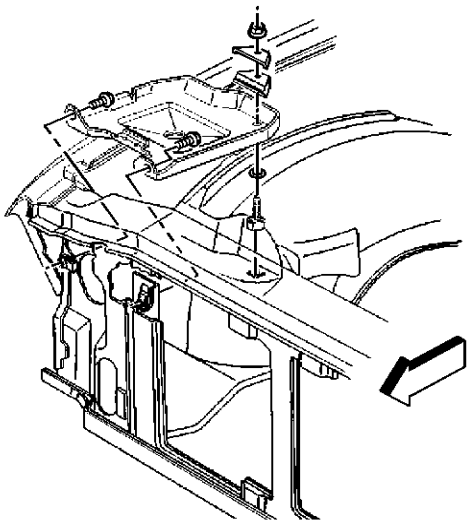
- Connect the battery positive cable.
- Connect the battery negative cable. Refer to **"Battery Negative Cable Disconnect/Connect Procedure"** .

  Tighten: Tighten the battery terminal bolts to 5 Nm (44 lb in).

Repair Instructions

Battery Tray Replacement

Removal Procedure

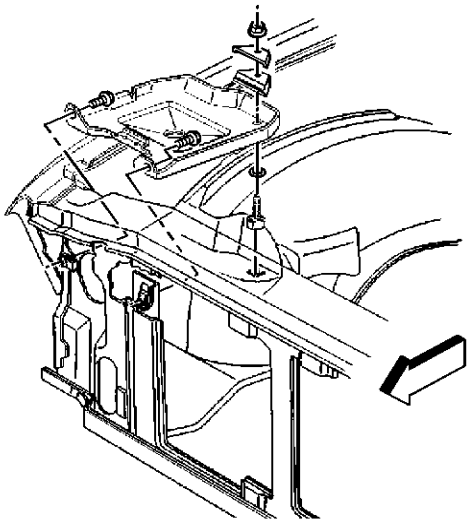
- 

  Remove the battery. Refer to **"Battery Replacement"** .

  Remove the battery tray retaining bolts.

- Remove the battery tray.

Installation Procedure

- 

  Install the battery tray.

- ***Notice:*** Refer to Fastener Notice in Cautions and Notices.

  Install the battery tray retaining bolts.

  Tighten: Tighten the battery tray retaining bolts to 25 Nm (18 lb ft).

- Install the battery. Refer to **"Battery Replacement"** .

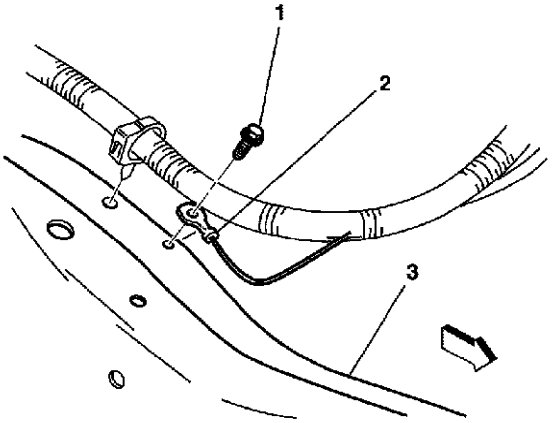
Repair Instructions

Ground Strap Replacement

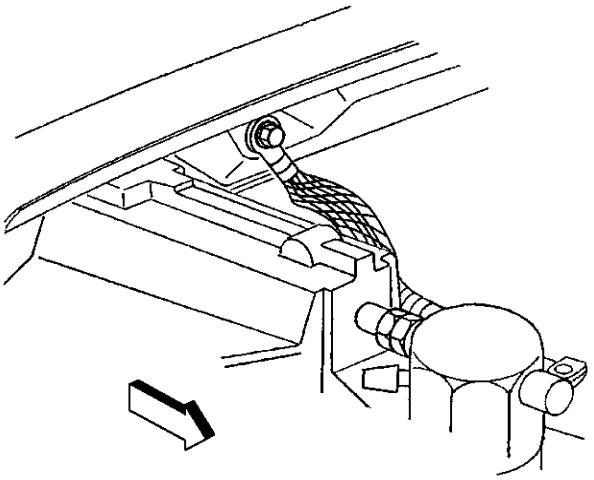
2001-S/T TRK (China)

Additional ground wire is used to connect the body and the frame to the engine and the transmission. Always connect all ground wires in order to ensure a good ground path to the battery for all electrical components.

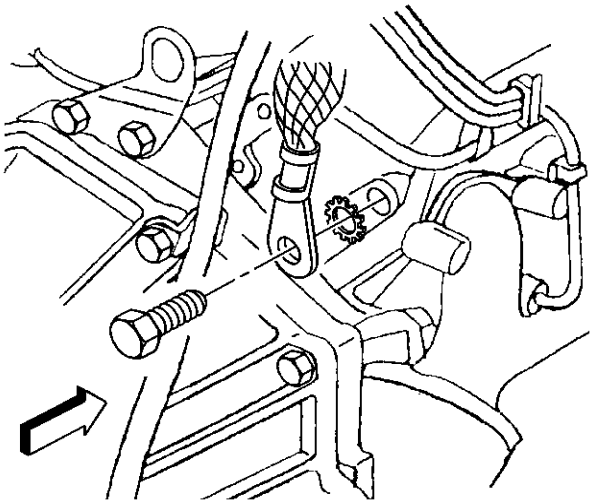
Refer to the following illustrations for ground strap connection locations:

- 

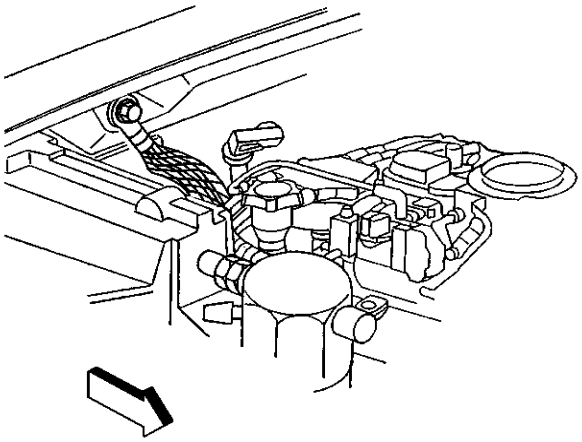
  Battery ground wire (2) connection to the vehicle frame (2.4L).

- 

  Engine ground strap connection to the cowl (2.4L).

- 

Engine ground strap connection to the engine (4.3L).

- 

Engine ground strap connection to the cowl (4.3L).

Repair Instructions

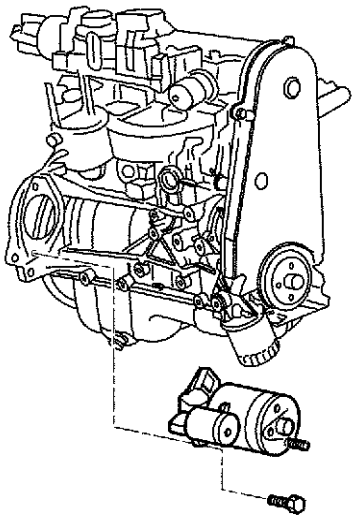
Starter Motor Replacement (2.4L)

Removal Procedure

Caution: Refer to Vehicle Lifting Caution in Cautions and Notices.

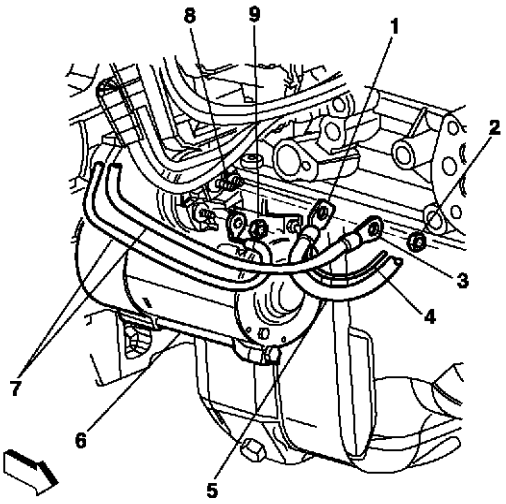
Caution: Refer to Battery Disconnect Caution in Cautions and Notices.

Notice: Never operate the starter motor for more than 30 seconds at a time. Allow it to cool for at least two minutes. Overheating, caused by too much cranking, will damage the starter motor.

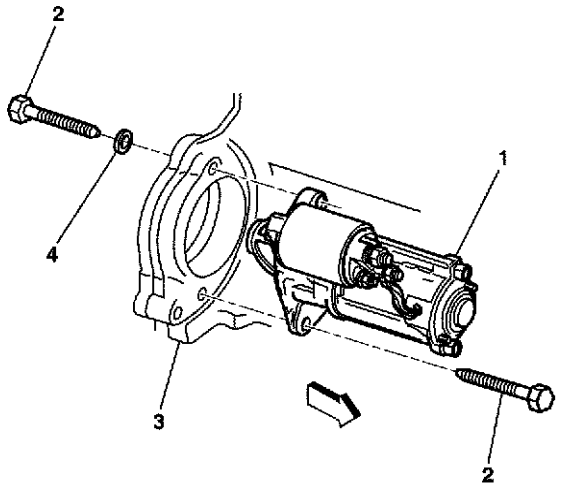
- 

Disconnect the battery negative cable. Refer to **"Battery Negative Cable Disconnect/Connect Procedure"** .

- Raise the vehicle and suitably support the vehicle. Refer to **"Lifting and Jacking the Vehicle"** in General Information.

- 

Disconnect the wires (7, 5) from the starter solenoid.

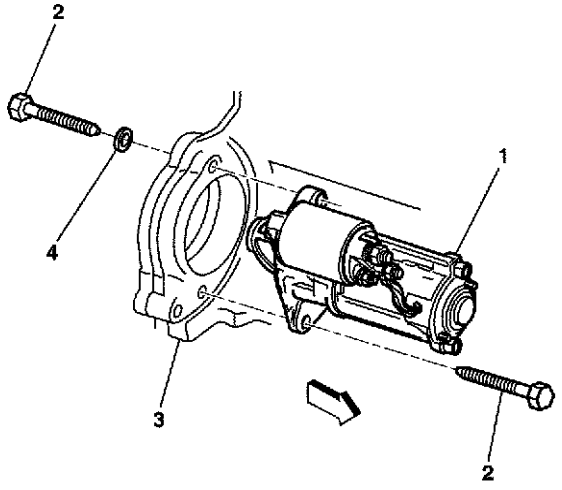


Remove the starter motor mounting bolts (2).

- Remove the starter (1) from the vehicle.

Installation Procedure

- ***Caution: Refer to Vehicle Lifting Caution in Cautions and Notices.***

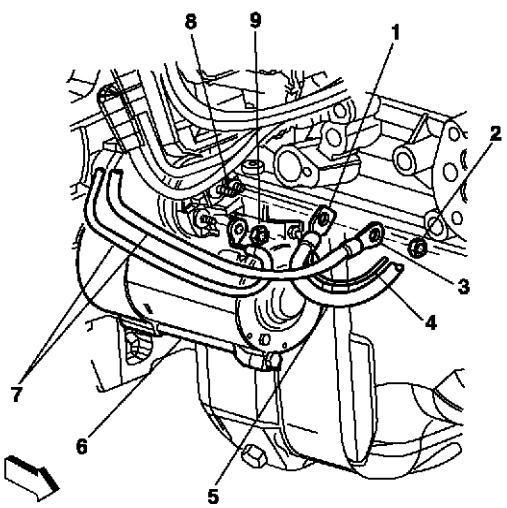


Install the starter motor (1) to the vehicle.

- ***Notice:*** Refer to Fastener Notice in Cautions and Notices.

Install the starter mounting bolts (2).

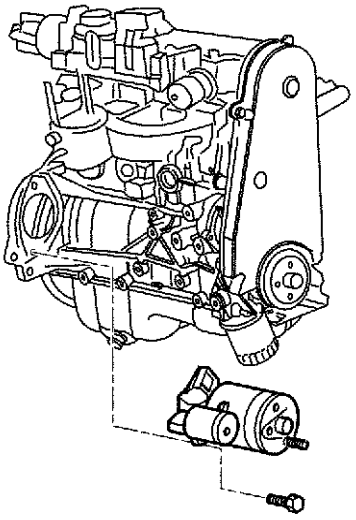
Tighten: Tighten the starter motor mounting bolts to 40 Nm (29 lb ft).



Connect the wires (7, 5) to the starter solenoid.

Tighten:

- Tighten the battery positive cable to starter nut to 10 Nm (88 lb in).
- Tighten the engine wiring harness to starter nut to 1.9 Nm (17 lb in).



Remove the supports and lower the vehicle.

- Connect the battery negative cable. Refer to **"Battery Negative Cable Disconnect/Connect Procedure"** .

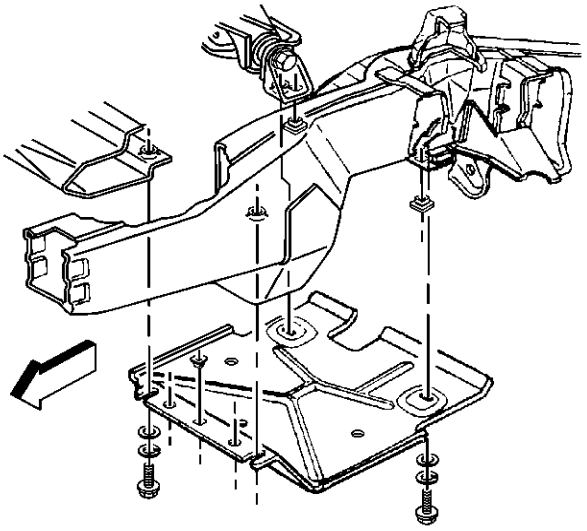
Repair Instructions

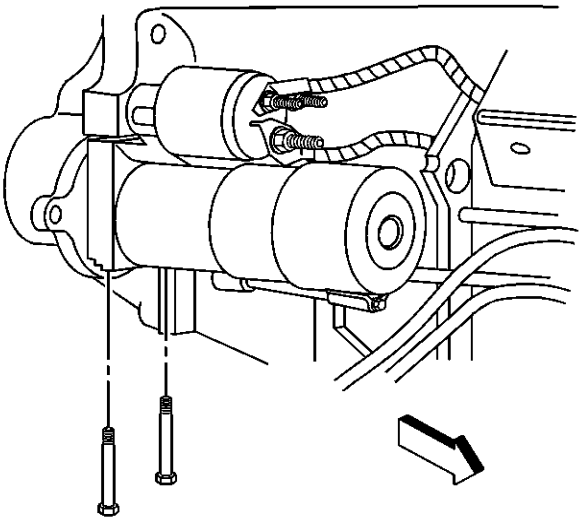
Starter Motor Replacement (4.3L)

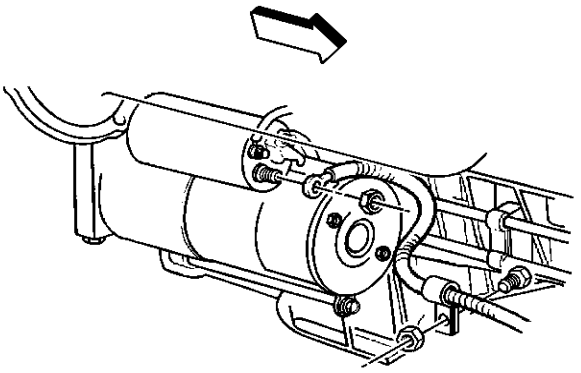
Removal Procedure

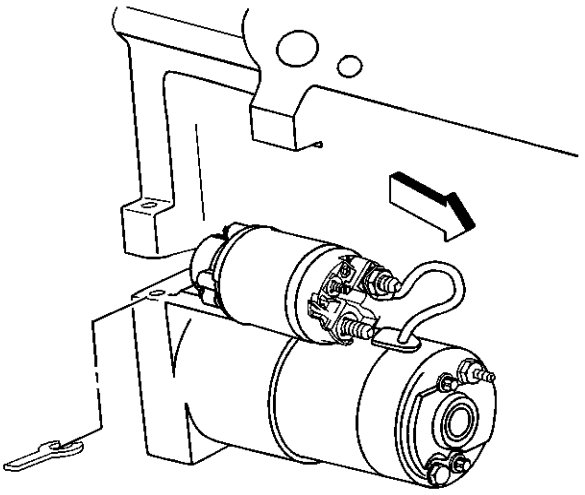
Caution: Refer to Vehicle Lifting Caution in Cautions and Notices.

Caution: Refer to Battery Disconnect Caution in Cautions and Notices.

- Disconnect the battery negative cable. Refer to **"Battery Negative Cable Disconnect/Connect Procedure"** .
- Raise and suitably support the vehicle. Refer to **"Lifting and Jacking the Vehicle"** in General Information.
- 

  Remove the differential carrier shield mounting bolts, if equipped.
- Remove the differential carrier shield, if equipped.
- 

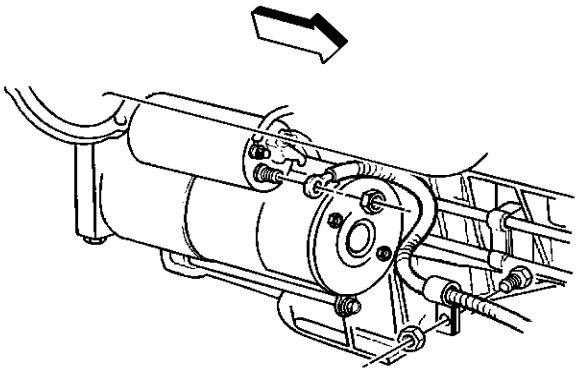
  Remove the starter mounting bolts.
- 

  Disconnect the wires from the solenoid.
- 

  Remove the starter from the vehicle.

  Note the location of the shims, if equipped.

Installation Procedure

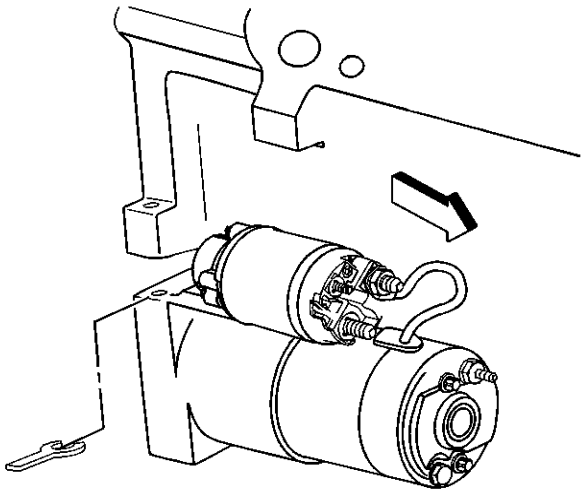
- 

Notice: Refer to Fastener Notice in Cautions and Notices.

Connect the wires to the solenoid.

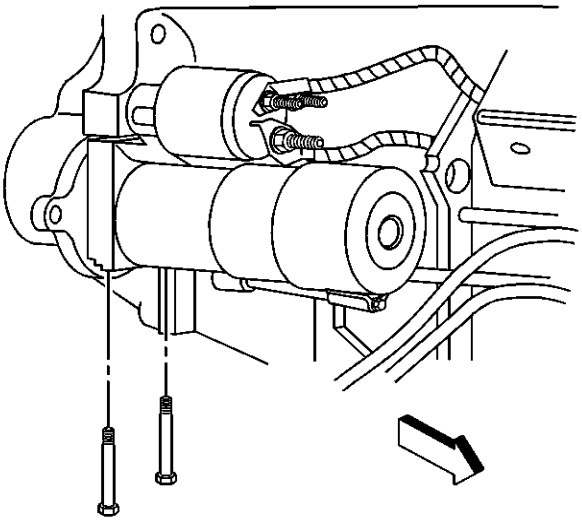
Tighten:

- Tighten the battery positive cable nut to 10 Nm (88 lb in).
- Tighten the engine wiring harness to starter nut to 1.9 Nm (17 lb in).

- 

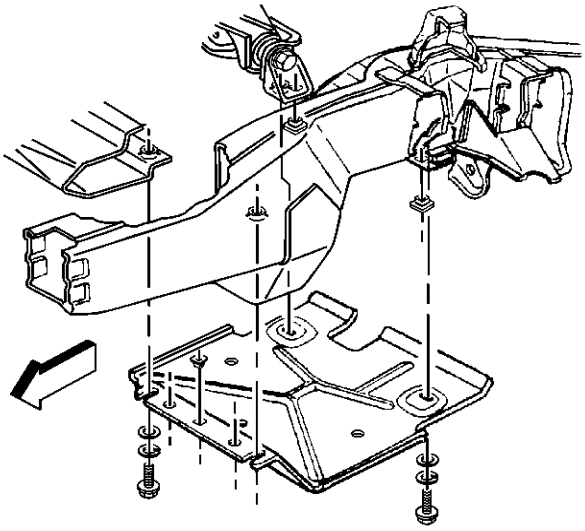
Install the starter and the inboard starter mounting bolt. Do not tighten.

- Install the starter shims, if equipped.

- 

Install the outboard starter mounting bolt.

Tighten: Tighten the starter mounting bolts to 50 Nm (37 lb ft).

- 

Install the differential carrier shield, if equipped.

- Install the differential carrier shield mounting bolts, if equipped.

  Tighten: Tighten the differential carrier bolts to 25 Nm (18 lb ft).

- Remove the supports and lower the vehicle.
- Connect the battery negative cable. Refer to **"Battery Negative Cable Disconnect/Connect Procedure"** .

Repair Instructions

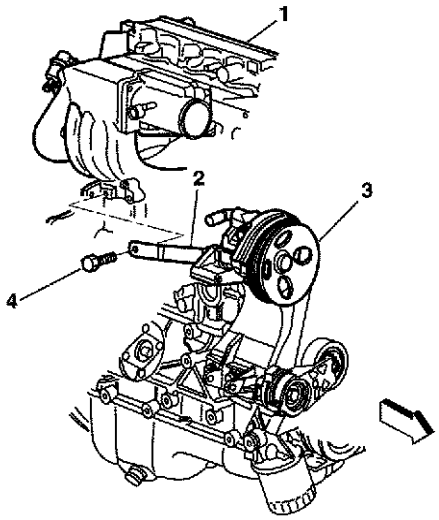
Generator Bracket Replacement (2.4L)

Removal Procedure

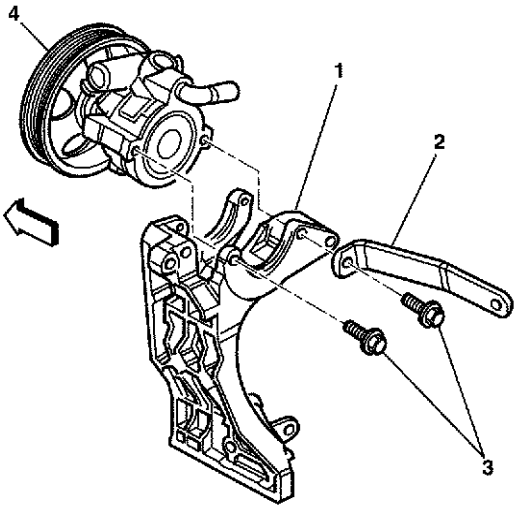
- ***Caution: Refer to Battery Disconnect Caution in Cautions and Notices.***

  Disconnect the battery negative cable. Refer to **"Battery Negative Cable Disconnect/Connect Procedure"** .

- Remove the drive belt. Refer to **"Drive Belt Replacement"** in Engine Mechanical – 2.4L.

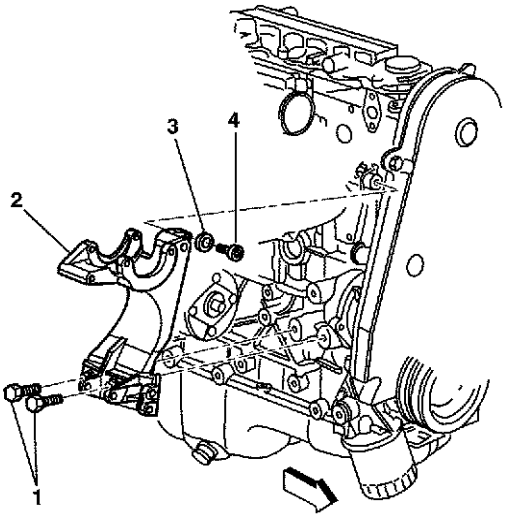
- 

  Remove the power steering pump secure bracket mounting bolt (4).

- 

  Remove the power steering pump mounting bolts (3).

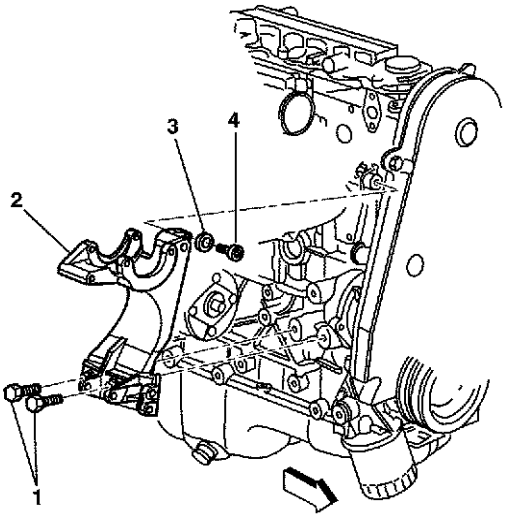
- Remove the generator. Refer to **"Generator Replacement (2.4L)" "Generator Replacement (4.3L)"** .

- 

  Remove the upper bracket bolt (4) and the lower bracket bolts (1).

- Remove the bracket from the engine.

Installation Procedure

- 

  Install the power steering bracket (2) to the engine.

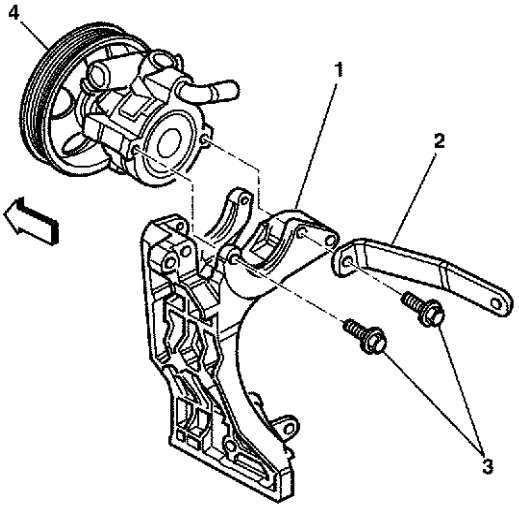
- ***Notice:*** Refer to Fastener Notice in Cautions and Notices.

  Install the upper bracket bolt (4).

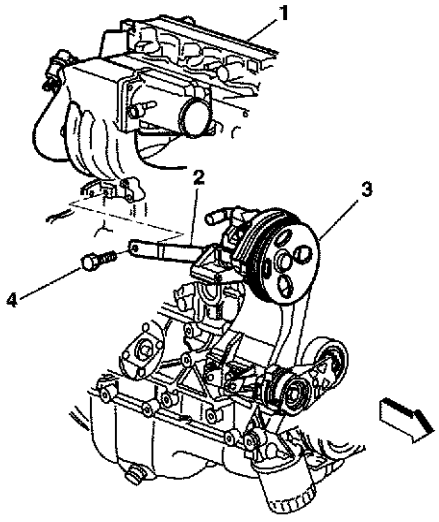
  Tighten: Tighten the upper bracket bolt to 25 Nm (18 lb ft).

- Install the lower bracket bolts (1).

  Tighten: Tighten the lower bracket bolts to 50 Nm (37 lb ft).

- Install the generator to the bracket. Refer to **"Generator Replacement (2.4L)" "Generator Replacement (4.3L)"** .
- 

  Install the power steering pump (4) and the secure bracket (2).
- Install the power steering pump mounting bolts (3).

  Tighten: Tighten the power steering pump mounting bolts to 25 Nm (18 lb ft).
- 

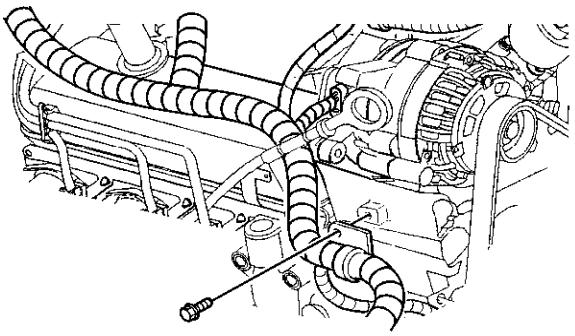
  Install the secure bracket mounting bolt (4) to the engine.

  Tighten: Tighten the secure bracket mounting bolt to 25 Nm (18 lb ft).
- Install the drive belt. Refer to **"Drive Belt Replacement"** in Engine Mechanical – 2.4L.
- Connect the battery negative cable. Refer to **"Battery Negative Cable Disconnect/Connect Procedure"** .

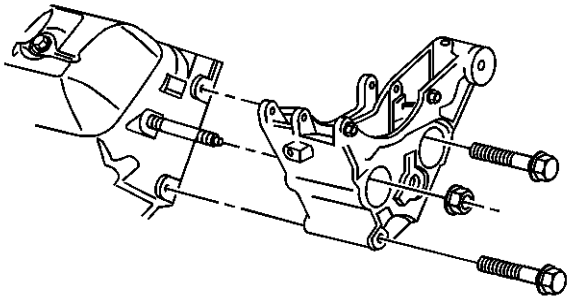
Repair Instructions

Generator Bracket Replacement (4.3L)

Removal Procedure

- 

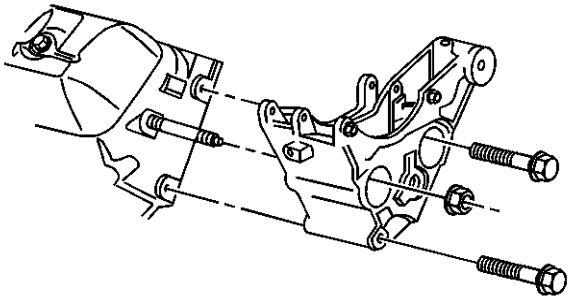
  Disconnect the battery negative cable. Refer to **"Battery Negative Cable Disconnect/Connect Procedure"** .
- Remove the engine cooling fan. Refer to **"Fan Clutch Replacement"** in Engine Cooling.
- Remove the drive belt. Refer to **"Drive Belt Replacement"** in Engine Mechanical - 4.3L.
- Remove the generator. Refer to **"Generator Replacement (2.4L)" "Generator Replacement (4.3L)"** .
- Remove the engine wiring harness bracket from the generator mounting bracket.
- Remove the drive belt tensioner. Refer to **"Drive Belt Tensioner Replacement"** in Engine Mechanical - 4.3L.
- Remove the drive belt idler pulley. Refer to **"Drive Belt Idler Pulley Replacement - Right"** in Engine Mechanical - 4.3L.

- 

Remove the two bolts and nut holding the generator mounting bracket to the engine.

- Slide the generator mounting bracket off of the stud.

Installation Procedure

- 

Slide the generator mounting bracket onto the stud.

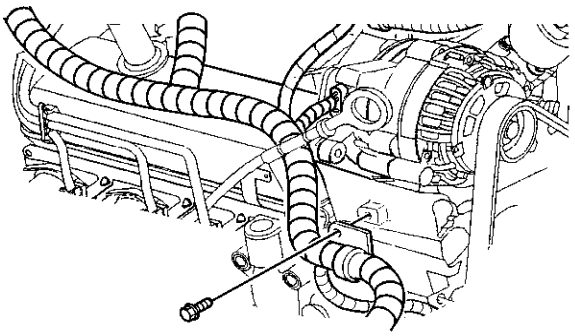
- ***Notice:*** Refer to Fastener Notice in Cautions and Notices.

  Install the two generator mounting bracket bolts and the nut.

  Tighten: Tighten the generator mounting bracket bolts and nut to 41 Nm (30 lb ft).

- Install the drive belt idler pulley. Refer to **"Drive Belt Idler Pulley Replacement - Right"** in Engine Mechanical - 4.3L.

- Install the drive belt tensioner. Refer to **"Drive Belt Tensioner Replacement"** in Engine Mechanical - 4.3L.

- 

Install the engine wiring harness bracket to the generator mounting bracket.

Tighten: Tighten the engine wiring harness bracket bolt to 25 Nm (18 lb ft).

- Install the generator. Refer to **"Generator Replacement (2.4L)" "Generator Replacement (4.3L)"** .

- Install the drive belt. Refer to **"Drive Belt Replacement"** in Engine Mechanical - 4.3L.

- Install the engine cooling fan. Refer to **"Fan Clutch Replacement"** in Engine Cooling.

- Connect the battery negative cable. Refer to **"Battery Negative Cable Disconnect/Connect Procedure"** .

Repair Instructions

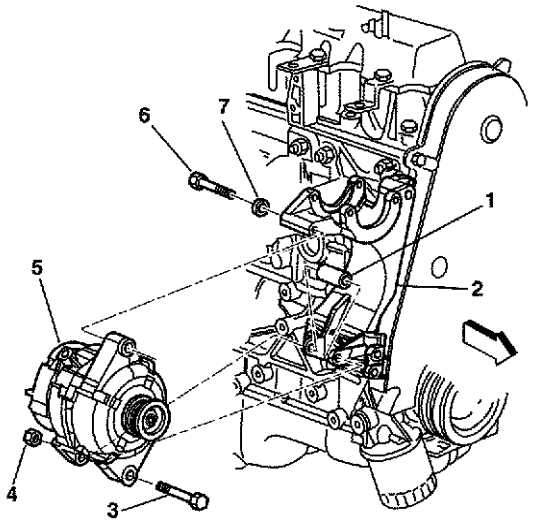
Generator Replacement (2.4L)

Removal Procedure

Caution: Refer to Battery Disconnect Caution in Cautions and Notices.

- Disconnect the battery negative cable. Refer to **"Battery Negative Cable Disconnect/Connect Procedure"** .

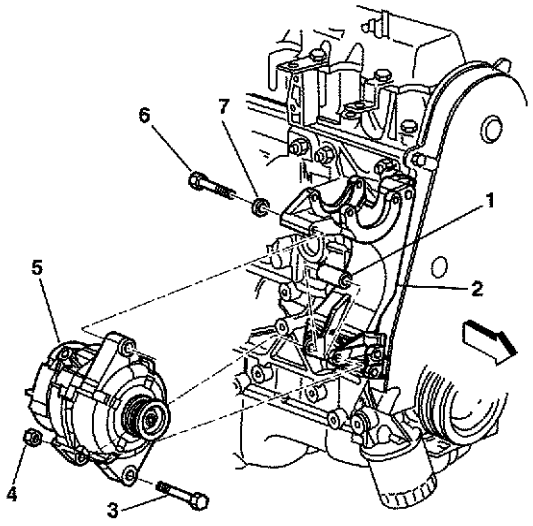
- Remove the drive belt. Refer to **"Drive Belt Replacement"** in Engine Mechanical – 2.4L.

- 

  Disconnect both electrical terminal wires from the back side of the generator.

- Remove the upper generator mounting bolt (6).
- Remove the lower generator mounting bolt (3) and spacer (1).
- Remove the generator from the vehicle.

Installation Procedure

- 

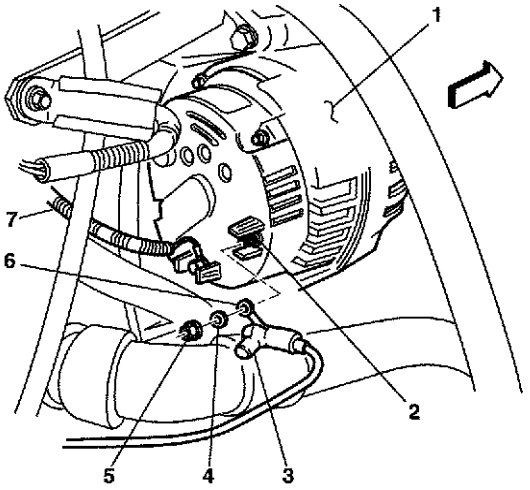
  Install the generator to the vehicle.

- ***Notice:*** Refer to Fastener Notice in Cautions and Notices.

  Install the generator attaching bolts (3,6).

  Tighten:

  1. Tighten the upper generator bolt to 25 Nm (18 lb ft).
  2. Tighten the lower generator bolt to 50 Nm (37 lb ft).

- 

  Install both electrical terminal wires and retaining nut to the generator.

  Tighten: Tighten the electrical terminal retaining nut (5) to 10 Nm (88 lb in).

- Install the drive belt. Refer to **"Drive Belt Replacement"** in Engine Mechanical – 2.4L.
- Connect the battery negative cable. Refer to **"Battery Negative Cable Disconnect/Connect Procedure"** .

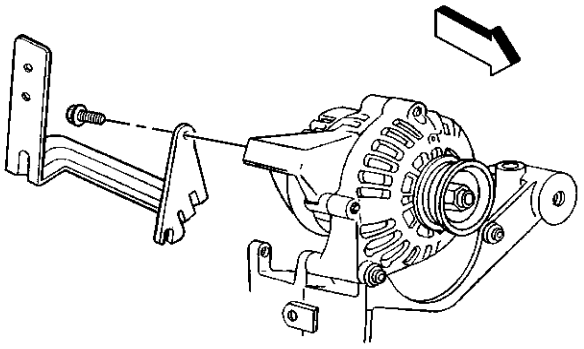
Repair Instructions

Generator Replacement (4.3L)

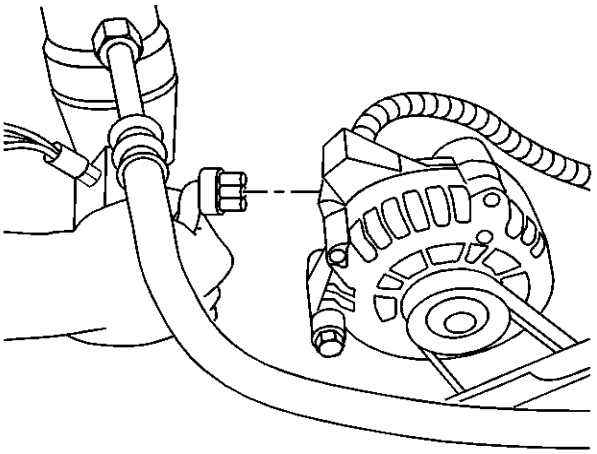
Removal Procedure

Caution: Refer to Battery Disconnect Caution in Cautions and Notices.

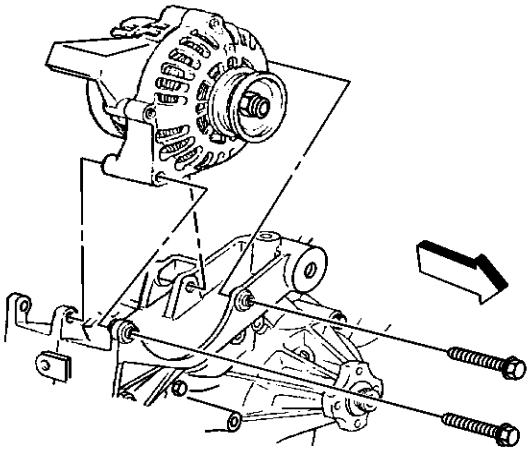
- Disconnect the battery negative cable. Refer to **"Battery Negative Cable Disconnect/Connect Procedure"** .
- Remove the drive belt. Refer to **"Drive Belt Replacement"** in Engine Mechanical - 4.3L.

- 

Remove the heater hose brace bolt from the generator.

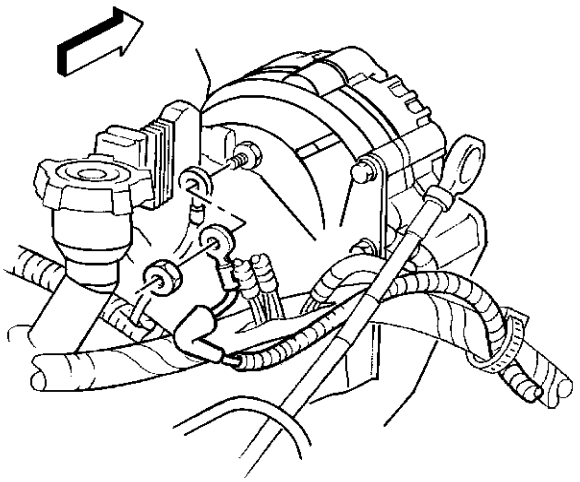
- 

Disconnect the generator electrical connector.

- 

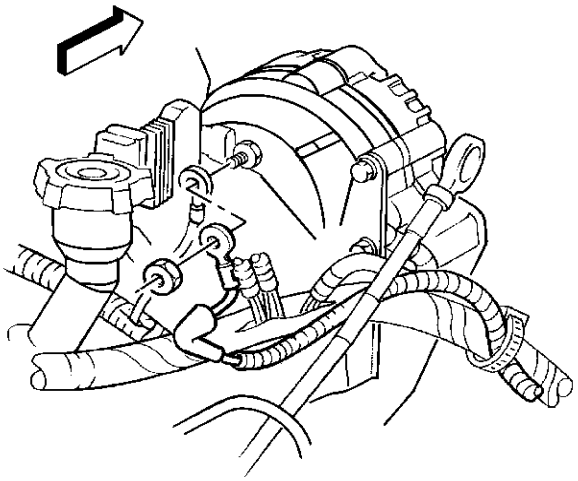
Remove the generator mounting bolts.

- Remove the generator from the mounting bracket.

- 

Remove the generator output (BAT) terminal retaining nut from the generator.

Installation Procedure

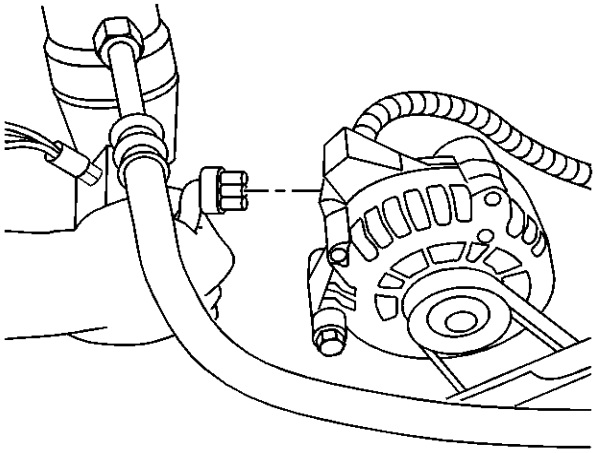
- 

Notice: Refer to Fastener Notice in Cautions and Notices.

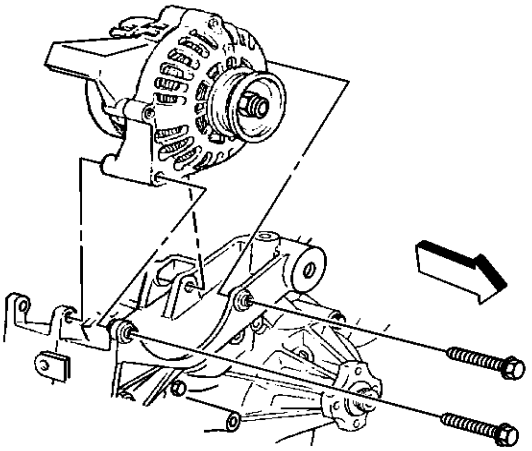
Connect the generator output (BAT) terminal wire.

Ensure the insulating boot is covering the terminal nut.

Tighten: Tighten the generator output (BAT) terminal nut to 17 Nm (12 lb ft).

- 

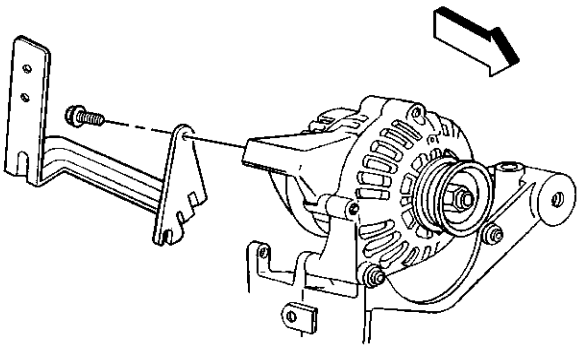
Connect the generator electrical connector.

- 

Install the generator to the generator mounting bracket.

- Install the generator mounting bolts.

  Tighten: Tighten the generator mounting bolts to 50 Nm (37 lb ft).

- 

Install the heater hose bracket bolt to the generator.

Tighten: Tighten the heater hose bracket to the generator bolt to 25 Nm (18 lb ft).

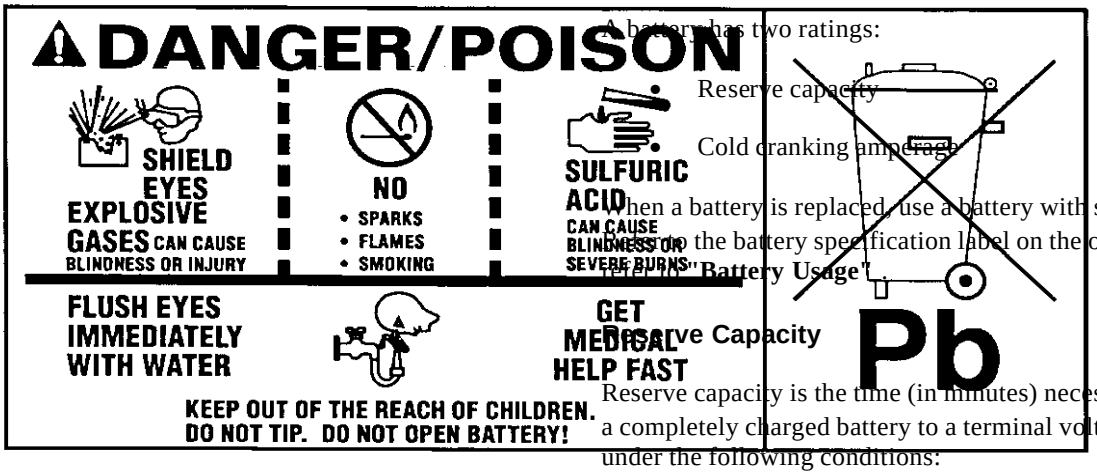
- Install the drive belt. Refer to **"Drive Belt Replacement"** in Engine Mechanical - 4.3L.
- Connect the battery negative cable. Refer to **"Battery Negative Cable Disconnect/Connect Procedure"** .

Description and Operation

Battery Description and Operation

Battery Precaution Caution: Batteries produce explosive gases, contain corrosive acid, and supply levels of electrical current high enough to cause burns. Therefore, to reduce the risk of personal injury when working near a battery:

- Always shield your eyes and avoid leaning over the battery whenever possible.
- Do not expose the battery to open flames or sparks.
- Do not allow the battery electrolyte to contact the eyes or the skin. Flush immediately and thoroughly any contacted areas with water and get medical help.
- Follow each step of the jump starting procedure in order.
- Treat both the booster and the discharged batteries carefully when using the jumper cables.



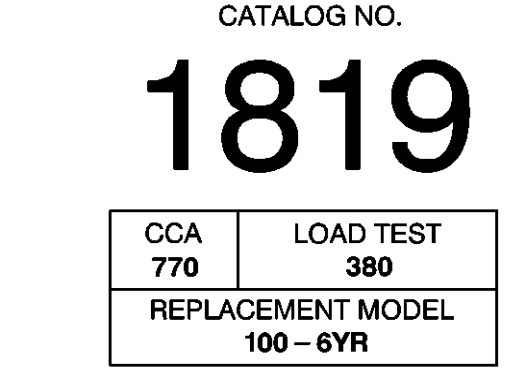
The maintenance — free battery is the standard original equipment battery. There are no vent plugs in the cover. The maintenance — free battery is completely sealed except for two small vent holes in the side. These vent holes release the small amount of gas that is produced in the battery.

The battery has three functions as a major source of energy:

- Engine cranking
- Voltage stabilization
- An alternate source of energy with a generator overload.

The battery specification label (example at right) may contain the following:

- The test ratings
- The original equipment catalog number
- The recommended replacement model number



Battery Ratings

A battery has two ratings:

- Reserve capacity
- Cold cranking amperage

When a battery is replaced, use a battery with similar ratings. Refer to the battery specification label on the original battery or Refer to **"Battery Usage"**.

Reserve Capacity

Reserve capacity is the time (in minutes) necessary to discharge a completely charged battery to a terminal voltage of 10.5 volts under the following conditions:

- A constant rate of 25 amperes.
- A constant temperature of 27° C (80° F).

Refer to **"Battery Usage"** for the reserve capacity rating of the original equipment battery.

Cold Cranking Amperage

The cold cranking amperage is an indication of the ability of the battery to crank the engine at cold temperatures. The cold cranking amperage is the minimum amperage necessary to maintain 7.2 volts for 30 seconds at –18° C (0° F). Refer to **"Battery Usage"** for the cold cranking amperage rating for this vehicle.

Description and Operation

Starting System Description and Operation

The starter motors are non-repairable. It has pole pieces that are arranged around the armature within the starter housing. When the solenoid windings are energized, the pull-in winding circuit is completed to ground through the starter motor. The hold-in winding circuit is completed to ground through the solenoid.

The windings work together magnetically to pull in and hold in the plunger. The plunger moves the shift lever. This action causes the starter drive assembly to rotate on the armature shaft spline as it engages with the flywheel ring gear on the engine. At the same time, the plunger closes the solenoid switch contacts in the starter solenoid. Full battery voltage is then applied directly to the starter motor and it cranks the engine.

As soon as the solenoid switch contacts close, current stops flowing thorough the pull-in winding as battery voltage is now applied to both ends of the windings. The hold-in winding remains energized; its magnetic field is strong enough to hold the plunger, shift lever, starter drive assembly, and solenoid switch contacts in place to continue cranking the engine. When the engine starts, the pinion gear overrun sprag protects the armature from excessive speed until the switch is opened.

When the ignition switch is released from the CRANK position, voltage is removed from the starter solenoid S terminal. Current flows from the motor contacts through both windings to ground at the end of the hold–in winding. However, the direction of the current flow through the pull–in winding is now in the opposite direction of the current flow when the winding was first energized.

The magnetic fields of the pull-in and hold-in windings now oppose one another. This action of the windings, along with the help of the return spring, cause the starter drive assembly to disengage and the solenoid switch contacts to open simultaneously. As soon as the contacts open, the starter motor is turned off.

Description and Operation

Charging System Description and Operation

Generator

The generators are non-repairable. They are electrically similar to earlier models. The generator feature the following major components:

- The delta stator
- The rectifier bridge
- The rotor with slip rings and brushes
- A conventional pulley
- Dual internal fans
- A voltage regulator

The pulley and the fan cool the slip ring and the frame.

The generator features permanently lubricated bearings. Service should only include the tightening of mounting components. Otherwise, the generator is replaced as a complete unit.

Regulator

The voltage regulator controls the field current of the rotor in order to limit system voltage. The regulator switches the current on and off at a rate of 400 cycles per second in order to perform the following functions:

- Radio noise control
- Obtain the correct average current needed for proper system voltage control

At high speeds, the on-time may be 10 percent with the off-time at 90 percent. At low speeds, the on-time may be 90 percent and the off-time 10 percent.

Special Tools and Equipment

Special Tools

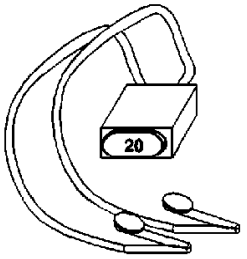
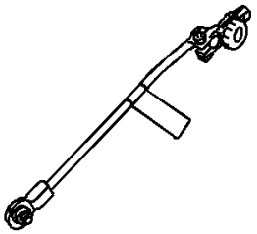
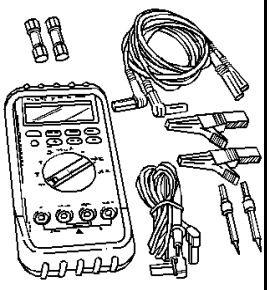
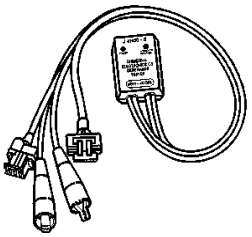
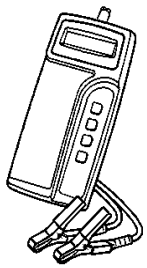
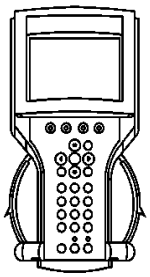
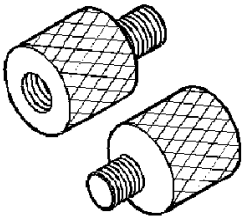
Illustration	Tool Number/ Description
	J 36169 Fused Jumper Wire
	J 38758 Parasitic Draw Test Switch Tool
	J 39200 High Impedance Multimeter (Digital Multimeter-DMM)
	J 41450-B CS Generator Electronic Tester

Illustration	Tool Number/ Description
	J 42000 Digital Battery Tester
	JBGM P/N 7000081 Tech 2 Diagnostic Scan Tool
	JBGM P/N 12303040 Battery Side Terminal Adapters